

Annual Review - 1953

The Mining Journal

Railway & Commercial Gazette

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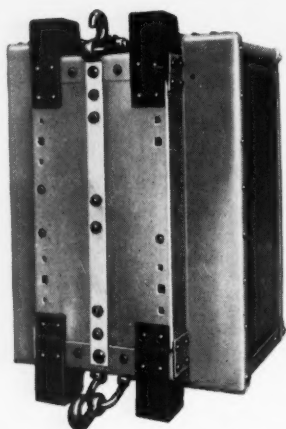
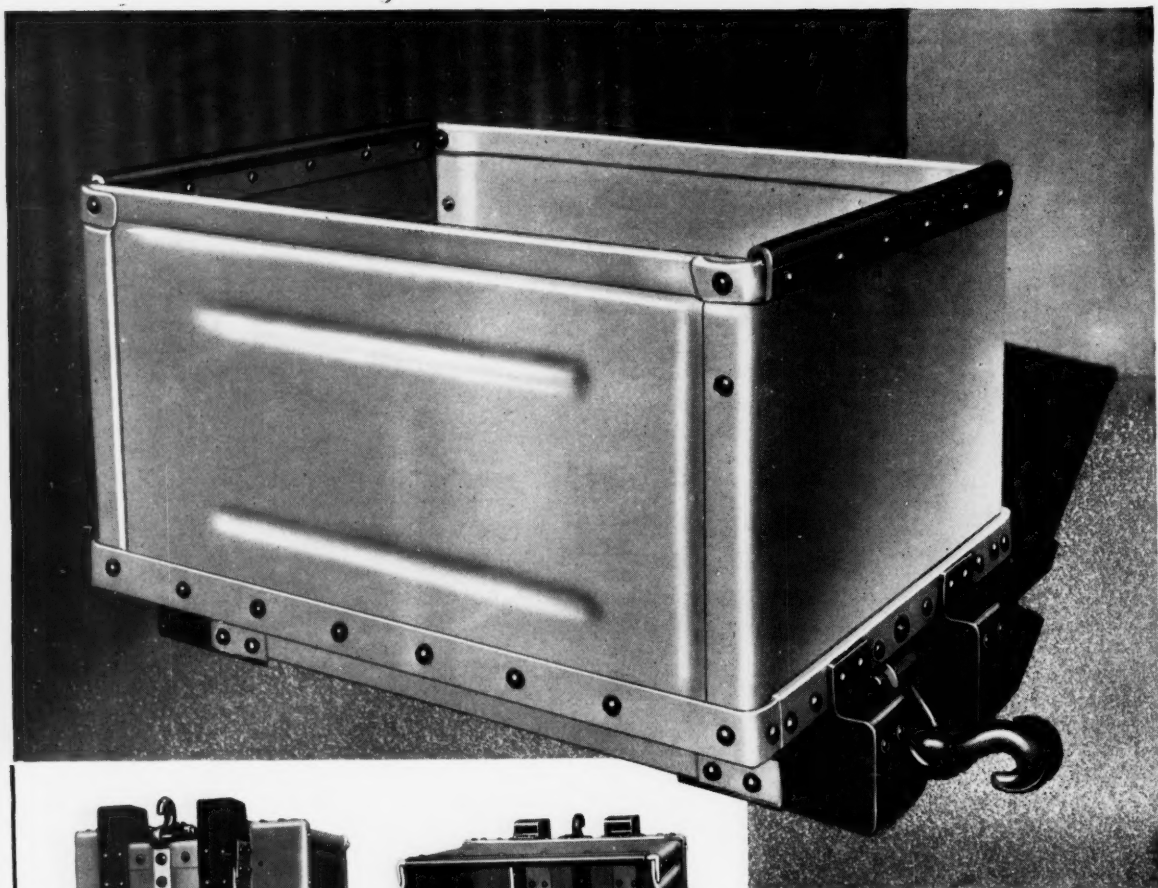
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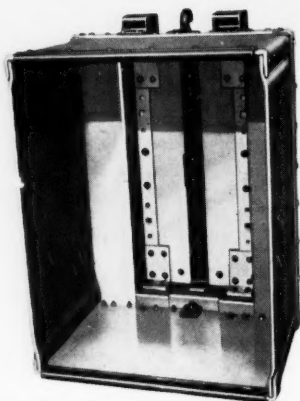
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The Mining Journal

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ANNUAL REVIEW

1953 Edition

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The Industry in 1952

IN publishing the Annual Review edition of *The Mining Journal* we had, many years ago, to make the choice as between publishing the *Review* in the first weeks of the new year, at which time little more than an impression of the events of the preceding year could be recorded, unsupported by year-end statistics, or, on the other hand, waiting until at any rate the majority of annual figures were available and until our overseas correspondents were themselves able to place the year in their respective countries in clearer focus. We believe that the decision we then took to follow the latter course has been more than justified by events, in that *The Mining Journal* Annual Review has, over the past decade or so, come to constitute a notably comprehensive and continuous historical record of the mining industry throughout the Free World.

Writing here a year ago when we were seeing the first indications of a break in the post-Korean inflation of metal prices, we referred to the growing anxiety regarding an eventual serious unbalance between production and consumption once stockpiling began to ease off and some of the major new mining projects, mainly inspired by the United States, began to make their weight felt on the market. We concluded that "in such a situation it may well be asked what would be the repercussions on the mining industry of the Free World if the Kremlin were suddenly to evince a new spirit of sweet reasonableness—if only as a tactical move in the Cold War."

To-day, that question is, in fact, being asked with some urgency. The answer to it lies very largely in the hands of the United States and it is consequently inevitable that in many of the articles which follow, developments in that country have received, what may appear to some, a disproportionate attention.

It may not be without significance that the latest Russian *volte-face* should have coincided with the return to office of the Republican Party after an interval of 20 years, which has inevitably created, if only temporarily, something of a vacuum in leadership at the White House while the new Administration is formulating its broad policies.

Of these, probably the most fateful to the mining industry are those concerning tariffs and in contrast those concerning aid to the underdeveloped areas of the world. President Eisenhower has at his disposal the voluminous recommendations of the Paley Report and, in substantial opposition to these conclusions, he has the energetic pressure of the domestic mining lobby. Readers of *The Mining Journal* are already aware of the broad conclusions of the Paley Report. This sees the United States now and for the future as basically a "have-not" country for the majority of metals and sees the answer to this situation on the one hand in stimulating research for new deposits at home, coupled where necessary with substitution and conservation measures, and on the other in substantially greater imports from other countries on terms advantageous to buyer and seller alike. In this latter, and clearly in the view of the Report more rewarding, field of action there are two major pre-requisites.

First there is the stimulation of the search for and increased output of metals in underdeveloped areas (somewhat on the lines described elsewhere in this *Review* in the article dealing with the Defence Materials Procurement Agency) and secondly, and as a logical consequence, there must be a complete reversal of traditional American thinking on tariffs. It would, we suppose, be unrealistic to expect anything but the strongest opposition to this kind of thinking from the mining States in the Union. Unemploy-

ment psychology in the United States, which can only have been stimulated by the events of recent months, is, in any event, too firmly ingrained for it to be easily demonstrable that the American standard of living requires no protection from the competition of lower paid foreign labour—at least under conditions of full employment. (And, be it said, if the Russian challenge is to be met, full employment must somehow be maintained.) Yet unless the statistics of the Paley Report are wildly at fault, continued full American employment at the rate of growth implied in population and other trends would seem an impossibility if self-sufficiency in the supply of raw materials is to be regarded as politically expedient.

Looking back behind these problems of immediate moment to 1952, this past year is seen broadly to be characterized by a change from an apparent condition of acute shortage and high price in most metals to one of heavy stocks and greatly reduced prices. The past year has also witnessed the progressive freeing of controls on the acquisition and use of most metals and in most cases the discontinuation of international allocation. The London Metal Exchange recovered much of its former influence as a world market with the resumption of dealings in tin and lead, and, since the turn of the year, in zinc, and now as we write, in copper, the resumption of free trading in which is announced for next August.

An inevitable concomitant of the rapidly shifting prices which we have recently been witnessing is a corresponding shift in the competitive relationship of the metals for those markets in which price plays an important part in substitution policy. This, however, by itself is an oversimplification as no metal-using industry is in a position to shift, for example, from the use of zinc-based to aluminium-based alloys with the same volatility as has characterized the price of the former metal, and the relatively stable price which has been displayed by aluminium since the war has undoubtedly added considerably to its attraction.

In the articles which appear in the early part of this *Review* we have endeavoured in a necessarily brief compass to survey at least the highlights of most, although not all, of the more important metals. We are only too conscious of the gaps which limitations of space, if nothing else, have imposed on this picture. To some extent, however, these have been filled in by reports from our foreign correspondents, while beyond that, portions of the picture are sketched in in yet greater detail in the articles recording the progress of individual mining companies to be found at the end of this volume.

Turning from the world economic picture to the consideration of mining events in some of the principal areas of production we find that, on balance, 1952 was another year of expanding activity. In so far as it is possible to exclude from one's mind the imponderables of the political situation in South Africa, 1952 saw the gold industry there well on the way to the solution of many of its current problems. In the Orange Free State the gold mining industry is emerging from a stage of exploration and development to become one of the world's important gold mining areas, with at least four of the new mines in production. While it would be too much to say that the problem of financing the new mines has been completely solved, original methods of finance, coupled with the shot in the arm provided by government-sponsorship of the new uranium industry makes it now appear at least probable that this problem will prove tractable. The same can, unfortunately, not yet be said of the problem of labour

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supply, the long-term solution of which lies largely in the political field. At this stage little can usefully be said in this connection other than to point to the self-evident economic fact that any great expansion in South African industrial activity must presuppose either a substantial increase in the white population or the upgrading of the native to the performance of many tasks from which he is at present precluded.

Events of the past year in the Rhodesias have, of course, been overshadowed by the issue of Federation, which now seems fairly certainly assured. For the mining industry this should mean more efficient utilization of available fuel and transport facilities, of which the Copperbelt may well be the first beneficiary as the principal exporting industry of the new Federation. Moreover, capital for the development of this whole area should now be more readily obtained in New York, no less than in London. While the supply of labour does not represent quite the same problem as it does in the Union, the differing degree of emancipation achieved by the native worker in Northern and Southern Rhodesia will inevitably present the new Dominion with a difficult problem of social adjustment. The remarkably business-like manner in which the African Mineworkers' Union appears to be conducting its affairs coupled with the encouraging manner in which the new Gold Coast government seems to be settling to its tasks, justifies the hope that progressive counsels will prevail on this issue.

One outcome of the confidence, which the West African government has begun to inspire in mining circles, has been the development of the Volta River scheme to the point where its initiation now promises to become a reality. In Nigeria the disappointment which must have been experienced over the withdrawal of the A.S. and R. from participation in the development of the new lead-zinc deposits in the Southern part of the Colony have, at least for the industry as a whole, been substantially offset by the U.S.A.'s seemingly inexhaustible appetite for columbite at astronomical prices.

In the Congo the industry continues to be expansionist, Union Minière's large development plans having progressed during the year, as have those of Géomines whose Manono property, if not already the world's largest tin mine, seems destined to become so. In East Africa, exploration and development rather than large-scale production have been the keynotes of the year, although exception must be made in the case of diamonds where the Williamson mines are again supplying their output to the Central Selling Organization. Aside from this, the most significant development in East Africa has been the plans to open up the Kilembe mine, situated on the eastern slopes of the Ruwenzori Mountains of Uganda which may eventually rank as one of the big copper-cobalt producers.

Looking across the Atlantic we find Canada achieving yet another record year. This great Dominion is experiencing unprecedented boom conditions and our only fear is lest the rate of development should place undue stresses and strains on the structure of its economy.

Mineral production in the United States recorded a slight decline, at least as regards the principal metals, and while there are a number of large development schemes on foot which will be bearing fruit within the next few years, it is significant that the Paley Report, at any rate, forecasts a declining U.S. production of copper and lead over the next 25 years, and only a very slightly expanding zinc production. In the case of aluminium a tremendous expansion is envisaged, although it remains to be seen how far these plans are hindered by the impending overloading of the nation's power resources.

In South America, we are presented with the contrast

on the one hand of vast United States capital investment for the mining of ores which, in the main, find their way into the North American market, and on the other of growing nationalism in such countries as Chile, Bolivia and the Argentine, which seeks to express itself in increasing its control over the indigenous mining industry and in a growing desire to refine and process the output of the mines rather than to export the less remunerative ores.

In the East, a similar nationalism has been finding expression in the growing control by the Indonesian government over the domestic tin industry, while in India the planning if not, in every case, the operation of the mining industry has for some years been in government hands. The future of the industry in Malaya, and still more in Thailand and Burma is bound up largely with the elimination of the menace of Communism, and as we write the gains which appear to have been made during the past year in Malaya are being offset by the deterioration of the situation in Indo China.

In Australia, 1952 was not marked by any sensational developments, although the volume of mineral production recorded an increase especially in the Westralian gold industry. The cost of labour in the mining industry in terms of real values is probably as high as anywhere in the world and this, coupled with the shortage of manpower and the power of the unions, is an undoubted brake on the expansion of the Commonwealth's mining industry.

In Continental Europe the event of the year has been the establishment of the European High Authority for coal and steel but it is too early as yet to foresee the outcome of this essay in supra-national economic government.

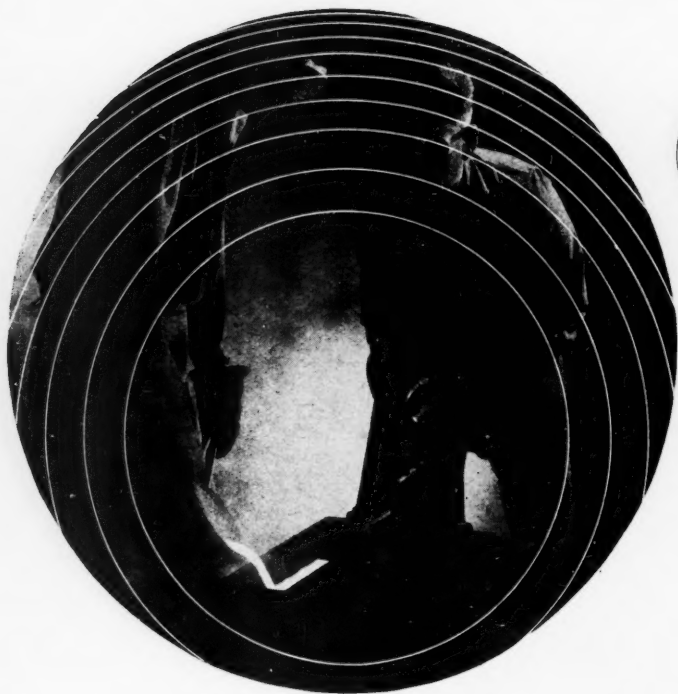
In Great Britain, the past year was again one of discouragement both for the home and overseas mining companies, and in the case of the latter emigration, where Treasury permission could be obtained, became increasingly attractive. This sombre picture has, however, been somewhat lightened by the Chancellor of the Exchequer in his recent Budget in which 40 per cent initial depreciation allowances have been granted to mining companies which will also benefit in common with industry as a whole from the abolition of E.P.L. as from January next.

The view is often expressed that there is no such thing as a real mineral shortage and that under conditions of apparent scarcity it is only necessary for prices to rise sufficiently for the necessary blocks of ore to be rendered economic. The obverse of this picture is that throughout the world it is becoming necessary to work lower and lower grade deposits to meet the appetites of industry. Progress on this front can only become possible under conditions of maximum technical efficiency both as regards the human factor and as regards mining methods and machinery.

The administrative and technical efficiency and the recruitment of mine management, as well as the supply and occupational training of labour are matters which have in recent years come increasingly to engage the attention of the British overseas mining industry, and there is scope for heightened productivity from work on this front.

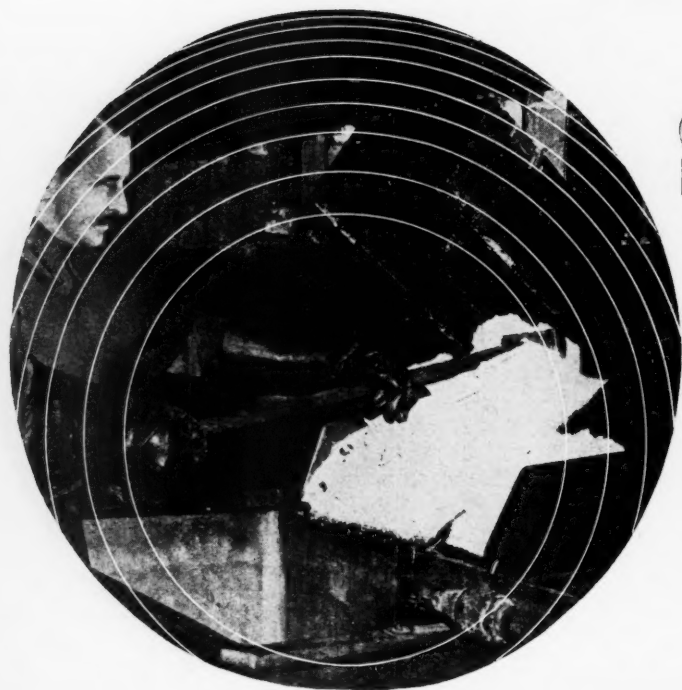
In the pages of this *Review* will, as usual, be found a series of articles summarizing progress with regard both to methods and machines. It is seldom that developments in any one year are spectacular, but 1952 was no exception in providing its quota of steady improvement and the widening adoption of better techniques and equipment.

Before passing on to report in detail the record of the past year it is perhaps necessary to remind readers that events which have occurred since the end of the year have only been referred to incidentally by way of placing the events of 1952 in perspective. The full history of what may well prove to be a momentous year must await the next edition of our *Annual Review*.



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Silver

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Gold

By E. BALIOL SCOTT

DESPITE many economic obstacles, world gold production increased last year. This computation takes no account of any increase or diminution in production in the U.S.S.R. and satellite countries. As the production table shows, there was an increase of 433,000 f.oz. among countries with an output in excess of 200,000 oz.; most of the countries recording a decrease are of minor importance and precise statistics for them are generally not available so early in the year.

Possibly the total Free World increase may have been of the order of 365,000 f.oz. For this we are mainly indebted to South Africa, which made the best showing since 1946, with a gain of 313,953 f.oz. Canada, despite the difficulties experienced by many concerns had the second best output with an increase of 27,210 f.oz. The United States output again declined and was down by 71,507 f.oz.; much of this total is by-product gold from base metal mines and reflects their showing rather than the intrinsic conditions in straight gold mines. Mexico, according to such returns as we have received, shows an important advance of 73,944 f.oz., and was the best return since 1947.

What is Russia's Output?

In computing the world's gold production, there seems a growing and not unnatural tendency to ignore the output from the Russian and satellite states. It is very many years since we have had any reliable data on this subject. The Union Corporation, on whose figures the accompanying table is mainly based, has for many years adopted a constant legend estimate of 2,000,000 f.oz.

On the other hand the report of the U.S. Director of the Mint has been steadily advancing their estimate which for 1951 they put 9,500,000 f.oz. In contrast with this remarkable total, *The Northern Miner* not long since gave an estimate of a little over 1,800,000 f.oz. These immense differences show how impossible it is to arrive at any satisfactory figure of the total output of the world. Certain *a priori* considerations may suggest that the output of the Iron Curtain countries may well be showing some decline of late. Russia probably acquired a considerable amount of the gold by its absorption of Eastern European states and in any case the output is probably in excess of disposals abroad. If Russia has all the gold she needs now it would only be reasonable to suppose that she would rather concentrate her manpower on more critical materials as well as industrial production. Anyway, there can be no doubt that Russia has large gold reserves and it is important in appraising the general gold picture not to ignore them even if we do not yet know to what use they may in due course be put.

The Industry in South Africa

With the development of the new mines in the O.F.S., South Africa seems likely to assume even greater importance as the world's biggest gold producer, providing that the present political and racial stresses do not affect the labour supply. We have been warned for many years to expect the time when obsolescent mines would have to close, and as the newer mines come into pro-

duction there must be a tendency for the marginal producers to contract, so that the increase from the O.F.S. properties may not therefore mean pure gain. Nevertheless, some of the older run mines are being given a new lease of life through the opportunity which has arisen of extracting uranium as a by-product, the necessary capital being lent by the Government. The immediate prospect for the South African gold industry is dealt with at some length by our correspondent elsewhere in this *Review*.

The Price of Gold

A subject of possibly greater, and certainly far more widely canvassed interest, is the possibility of a freeing of the gold market and a rise in price commensurate, at any rate in part, with the general rise in the price of commodities and raw materials. During the year Southern Rhodesia, Australia, New Zealand, the Gold Coast and the Crown Colonies followed Australia and Canada in disposing of their full output on the free market.

But no doubt partly as a consequence of this the premium on the official gold price was little more than \$2.00 an oz. for most of the year. The figure fluctuates according to the changing views in different countries as regards the prospects of inflation or the reverse, but the major uncertainty still remains—namely, what in the long run is likely to be the policy adopted by the U.S.A. towards the freeing of gold and the ultimate return towards a gold standard?

President Truman and Mr. Schneider resolutely withstood any change but President Eisenhower has indicated a much more open mind.

To finance ministers of debtor countries hard put to it to maintain a safe margin of gold and dollar reserves for external trading the possibility of augmenting their currency value by an increase in the price of gold is tempting and even the United States with a national debt of some \$64,000,000 might see the advantage of meeting old obligations with a depreciated currency. The principal objection raised is of course that depreciation of currency spells inflation, and it might prove difficult to insulate such a change from its effect on the internal currencies of individual countries. However, as things are at present, the decision as to whether the price of gold should be increased rests entirely with the United States.

Gold versus the U.S.A. Dollar

In this connection it may be observed that the debtor nations are beginning to display a preference for gold over United States currency as a backing for their currency reserves. There was certainly a tendency towards the end of the year and since for the U.S. gold stocks to decline, the last figure available being \$22,611,000, as compared with \$23,290,000 a year earlier but this figure fluctuates with conditions of international trade. However, as gold naturally gravitates to the United States Treasury the fact that the stock did not increase despite the additional supply furnished by the world's gold mines last year, is worth consideration, though the extent of foreign aid from America may be sufficient to account for the decline.

WORLD'S PRINCIPAL PRODUCERS

	excluding U.S.S.R. and satellites		
	1951	1952	Increase or decrease
S. Africa	11,505,649	11,819,602	+313,953
Canada	4,392,790	4,420,000	+27,210
U.S.A.	1,957,543	1,886,036	-71,507
Australia	896,000	978,000	+82,000
Gold Coast	699,000	691,000*	-8,000
S. Rhodesia	487,000	497,000	+10,000
Colombia	430,732	422,240	-8,433
Mexico	386,172	460,116	+73,944
Philippines	367,000	400,000*	+33,000
Congo	352,000	350,000	-2,000
Nicaragua	259,000	225,000*	-34,000
India	226,000	243,608	+17,608
Brazil	200,000*	180,000*	-20,000
Chile	174,000	180,000*	+6,000
Japan	177,000	175,000*	-2,000
Peru	142,000	140,000*	-2,000
Tanganyika	129,439	130,851	+1,412
New Guinea	94,000	120,000*	+26,000
Fiji	94,000	95,000*	+1,000
Sweden	80,000*	80,000* Unchang'd	
N. Zealand	75,115	50,000*	-25,115
Korea	100,000*	50,000*	-50,000

*Estimated.

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Silver

By E. BALIOL SCOTT

ONCE again in 1952 silver has been outstanding among other metals for relative stability of price and in consequence of an absence of the excitements and speculative interest which have characterized the base metals. The anticipation expressed in last year's *Review* that the year would be one of stability, was realized and though it shared with the rest of the metals in a downward price tendency, the decline was of a very minor order. So long as India and China remain isolated as major consumers, this condition seems likely to persist. As in the previous year the Bank of Mexico exercised the principal influence on price fluctuation, buying and selling silver so as to maintain a stabilized position.

Production

Early in the year it is always necessary to estimate output for a number of countries, for which the statistics only gradually become available. Thus, we find Messrs. Handy & Harman's estimate for 1951, of 155,200,000 oz. increased on revision to 166,900,000 oz., and their estimate for 1952 of 172,000,000 oz. may also eventually be revised upwards. Chief increase was shown by Mexico which is reported to have produced 45,500,000 oz. as compared with 43,800,000 oz. in the previous year. On the other hand, mine production of silver in the United States is reported by the U.S. Bureau of Mines as some 2 per cent lower at 39,101,000 oz. against 39,907,000 in 1951. Outside the Western Hemisphere production is estimated by Messrs. Handy & Harman at 31,000,000 oz. compared with 30,000,000 oz.

Prices

Market prices tend to reflect the general trend towards lower values exhibited in all the metals. The New York price averaged 84.941c. per f.oz. as against 89.368c. in 1951, and London, which is largely based on New York, averaged 74.360d. as compared with 77.856d. The New York market opened at 88.0c., which proved the highest point and fell to 82½c. at the end of May from which it recovered to 83½c. at which figure the year closed. The London extremes were 77d. at the opening of the year and 72½d. at the end.

Consumption

There was a general decline in the world's industrial consumption of silver which is computed at 127,200,000 oz. as against 148,100,000 in the previous year. This decline was principally due to lower consumption in the United States, the total being estimated at 95,000,000 oz. as against 110,000,000 in 1951; but the U.K. consumption was also lower being estimated at 11,000,000 oz. as against 16,500,000 oz. Germany also was slightly down at 11,300,000 as compared with 11,500,000 oz., as was Canada with 4,200,000 as against 4,600,000 oz.

On the other hand coinage requirements showed a marked increase totalling 104,100,000 as against 84,000,000 oz., the United States being principally responsible with

a total of 57,300,000 as against 44,400,000 oz., all for increased requirements in silver coins of subsidiary denominations. Saudi Arabia contracted with Mexico for some 23,000,000 oz. as against 21,000,000 in 1951, and Mexico took 8,300,000 for internal coinage requirements as compared with 4,500,000 in 1951. Canada also required somewhat more silver for coinage, with an estimate of 4,200,000 oz. as against 3,800,000 oz.

In all, total silver consumption for all purposes is computed as 231,300,000 as against 232,100,000 oz. The United States' coinage requirements caused a big drop in the Treasury's stocks of free silver from 124,500,000 oz., to approximately 79,100,000 oz. at the end of the year, an amount substantially greater than the newly mined domestic silver output. The industrial use of the metal for silverware declined to less than half the total absorbed, but industrial requirements increased both for defence and for civilian use. Consumption for silver brazing alloys and in the chemical, electrical and electronic fields increased.

Lease-Lend Silver

With the ratification of the Japanese Peace Treaty in April last year, the five-year period set for the return of some 410,500,000 oz. of lease-lend silver commenced. Belgium is the only country so far which has returned any lease-lend metal, the amount returned being 261,333 oz. out of a total of about 300,000. India which borrowed 226,000,000 oz., is the chief debtor and in May the Indian Finance Minister said that India would repay her loan from surplus stocks of silver in India derived from silver quaternary coins withdrawn from circulation and to

be replaced by nickel. The U.K. is obligated to return 88,300,000 oz., the Netherlands 66,700,000 oz., Saudi Arabia 22,300,000 oz., Australia 11,800,000 oz. and Ethiopia 5,400,000 oz.

So far as the U.K. is concerned, stocks of desilvered metal are expected to contribute to the U.K. returnable silver and Mr. Boyd Carpenter mentioned recently that £1,000,000 had been set aside in this year's Budget for increasing the Government's silver stockpile. The return of this big loan of silver should help eventually to counter the steady drain on U.S. Treasury stocks; at the same time, it is believed in authoritative quarters that ample power exists to call in silver certificates and release silver for further subsidiary coinage should this prove necessary.

One way or another there should therefore be abundant free silver available to meet the U.S. coinage requirements and supply American industry at a ceiling price of round about the 90c. Treasury level, while the stabilizing policy which the Bank of Mexico has pursued in recent times should provide a floor and give promise of the continuation of the relative stability which the market presented last year. What may happen in the more remote future if the Indian embargo on imports were withdrawn and China again became a silver-using country are problems which do not concern us to-day.

PRODUCTION AND PRICE Excluding U.S.S.R. and satellites (in millions of f.oz.)

PRODUCTION	1950	1951	1952
Mexico	49.1	43.8	45.5
United States	42.1	39.9	39.1
Canada	22.4	23.2	24.4
Peru	13.5	14.9	17
Australia	10.7	10.5	11
Bolivia	6.6	7.7	6
Japan	4	7	7.5
Other countries (estimated)	14.6	20.6	21.5
TOTAL	163	167	172
AVERAGE PRICE			
New York c. per oz.	74.169	89.368	84.941
London d. per oz.	64.796	77.856	74.360

(Sources: Handy & Harman, U.S. Bureau of Mines, Canadian Bureau of Mineral Statistics and Australian Bureau of Mineral Statistics).



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The Platinum Metals

CONSIDERING the high values of the platinum metals, and how essential they are to a wide range of industry, the absence of available information, statistical and otherwise, is remarkable. A policy of secrecy appears to be imposed on the industry in South Africa, at least so far as production figures are concerned, which seems to be leading to similar reticence elsewhere. This situation resulted in reports published from time to time during the year that production was increasing somewhat rapidly, whereas on the basis of such statistics as we have been able to collect, outputs, with the exception of the Transvaal, were lower.

Canadian Production

The Canadian output for the year was 269,000 oz., compared with 318,388 oz. in 1951, according to the Canadian Mineral Resources' Bureau figures, a decline of 48,488 oz. Of this total the platinum output was 120,300 oz. (153,483 oz. in 1951), and the associated metals 149,600 oz. (164,905 oz. in the previous year).

This decline is reflected in the International Nickel Co.'s statement of their sales during the year, which are given as 287,135 oz. as against 375,438 oz. in 1951. This decline of some 88,000 oz. in sales can be taken only as confirmation of a reduced Canadian output, as it does not show how much of the total is platinum and how much the associated metals. Moreover, we are not told to what extent stocks were drawn on in 1951. Incidentally, it was stated in the Inco report that competition of palladium from other sources was the principal cause of the decline in sales and that deliveries of platinum itself were in line with production capacity.

Our South African correspondent reports the Transvaal sales at 172,766 oz. of the combined metals as against 145,395 oz. in 1951, a gain of 27,371 oz.

Production in Colombia, usually the third largest world producer, is difficult to determine. The official export figure for the first eight months was 5,891 crude oz. but there was probably a good deal of material which escaped notice. Curiously enough, most of these exports are shown as shipped to the U.K. We have not received the U.S. Bureau of Mines report of imports into the United States for the full year, but during the first nine months the figure was 12,201 oz. of unrefined material, while Mexico supplied 3,090 oz. in the same period, which may well have been material originating in Colombia.

Production appears to have been proceeding quietly in Ethiopia as the U.S. imported 1,303 oz. in the first quarter of last year, but there is no mention of any later shipments.

We have so far no figures of the Alaskan production last year.

The U.S.S.R. of course remains a sealed book, but until the last year or so there were occasional substantial shipments of palladium made to the United States.

Price

Prices were being kept under control during most of the year. In the United States a nation-wide price of \$93 per oz. was imposed in the early part of the year, but in order to get rid of an accumulated supply, a ceiling of \$105 was fixed on April 26 for the ensuing three months, after which price reverted to the former level. Here prices were maintained at the previous year's level of £33-£27.

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Copper

By E. BALIOL SCOTT

LAST YEAR was a great year for copper even if the output of refined fell slightly short of 1951, being computed by the Copper Institute as 2,385,538 s.tons compared with 2,424,802 in 1951. Their figures for crude production, however, were higher at 2,418,472 s.tons compared with 2,405,692. These figures of course are those reported to the Institute by its members and total world production would be somewhat larger. The U.S. Bureau of Mines, in a report prepared at the end of January, estimates world production at about 2,800,000 s.tons, slightly less than the 1951 figure.

The picture changed steadily during the year and still more rapidly under the influence of the Korean *détente* since the year ended. In the United States and probably elsewhere the continuance of the high price level tended to encourage the mining of marginal ores and the lowering of grade was probably also a minor cause for the small decline in output. Strikes, more particularly in Chile and Northern Rhodesia, were also a retarding influence though in the United States strike influence on production was less.

United States

In the United States production of refined was about 10,000 tons down; the Copper Institute's figure being 1,189,112 s.tons compared with 1,199,784 in 1951. Crude, including secondary crude, is given as 1,007,889 s.tons against 1,021,499. The supply of copper was very tight in the early part of the year and President Truman authorized the release of an additional 22,000 s.tons from the strategic stockpile in May. Subsequently, supplies became easier in the second half of the year because of increased imports, which improved by some 36 per cent in the last six months and some 20/25 per cent for the whole year. As a result the D.P.A. moved copper from the "most critical" list of materials into that of materials in "approximate balance." U.S. imports in the first eleven months of the year were 547,169 s.tons against 489,376 for the whole of 1951, consisting chiefly of refined metal. Stocks of refined declined from 35,000 s.tons to 24,000, but blister, etc., increased to 185,000 s.tons from 182,000 at the end of 1951.

Consumption must have been large as withdrawals of new copper are given as 1,399,000 s.tons against 1,303,000 in the previous year while total withdrawals which included old and new copper were 1,769,000 as compared with 1,761,000 s.tons. It is of course impossible to judge how much of this total may have been for the strategic stockpile the more so as releases from the stockpile were generally stated to be subject to later replacement but consumption is provisionally estimated to have been about 3 per cent up on the year. Production of secondary copper again declined to 922,000 s.tons compared with 932,282 in 1951. The chief change here was an increase of some 18,000 s.tons to 492,000 derived from new scrap and a fall of 28,000 s.tons from old scrap at 430,000 s.tons.

Chile

Production of Chile would appear to have been about 404,000 tonnes compared with 380,000 in 1951. Of this 375,000 tonnes came from the big American producers Chuquicamata, El Teniente and Potrerillos, about 12,000 tons from the Government smelter at Paipote, and some 17,000 tonnes in the form of exports of ore and concentrates. The industry was considerably hampered by strikes, while the National Bank's policy of paying the producers only at the rate of 24½c. per lb. while selling at 35½c. was hardly calculated to encourage the companies

to go all out. In the current year the starting up of the new sulphide plant at Chuquicamata should considerably enhance output.

Northern Rhodesia and the Congo

Production from Northern Rhodesia increased but slightly during the year totalling 312,354 tons compared with 309,142 in 1951. The failure to enlarge output materially was due partly to labour trouble but even more to difficulties in the coal supply from the Wankie collieries which has still further curtailed production in the early months of the present year.

Production in the Belgian Congo showed a substantial increase with a total of 204,219 tonnes, which was a record figure, compared with 189,929 in 1951. Like Northern Rhodesia, the Union Minière was hampered by fuel difficulties which, however, it is hoped to overcome when the big hydro-electric plants now in progress are finished.

Canada and Mexico

Canadian production fell by about 4½ per cent and totalled 257,706 s.tons compared with 269,972 s.tons in the previous year. The refined output was affected by the strike at the Canadian Copper-Refineries' plant at Montreal and was reduced by about 21 per cent to 194,000 s.tons.

The Mexican output appears to have declined again last year. On the basis of monthly average figures we estimate the output at 58,500 tonnes compared with 64,400 tonnes in 1951.

Minor Producers

Among the minor copper producers, statistics of whose output in 1952 for the most part are inevitably not yet available are: Japan, whose output in 1951 was 46,625 s.tons; Yugoslavia, 39,628 s.tons in 1951; South Africa, 37,606 s.tons (sales) in 1952 compared with 38,533 s.tons in 1951, with possibly about 12,000 tons from South-West Africa. In 1951, Peru yielded 35,924, Cyprus 25,145, Cuba 21,529, Turkey 17,884 s.tons, Finland 19,517, Sweden 15,900, Norway 15,873, and the Philippines yielded 14,012 s.tons. The 1952 production of Australia was about 16,000 tons which should rise to some 34,000 tons in the current year with the coming into operation of the Mount Isa smelter, but this is a little more than half the estimated consumption requirements. Mount Lyell may also show some improvement in the coming year.

There are no figures of production or consumption available for the U.S.S.R. and satellite countries, but Russia was credited with an output of 280,000 s.tons in 1951.

Chile's Influence on Prices

It was the situation which developed in the selling prices for copper which was probably the most outstanding and certainly the most troublesome feature in the experience of the copper industry of 1952. With an international free market still lacking, prices were determined partly by Government controls and partly by political developments based on the economic necessities of various countries.

The main source of the trouble was the decision by the Chilean Government to denounce their earlier agreement made with the United States, for the delivery of the bulk of its output to that country at a price of 27½c. per lb. with 20 per cent reserved for sale elsewhere at an unspecified figure. After Chilean exports were embargoed the Office for Defence Mobilization authorized importers to pay higher prices, and pass on to consumers 90 per cent of the costs above 27½c., subsequently varied to increased

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costs above 24½c. With this relaxation the Chilean price soon rose to 35.5c. f.a.s. Chilean ports or about 36.5c. delivered in the U.S. On June 24 the O.P.S. exempted imported refined copper and copper refined from imported materials from price controls.

Meanwhile throughout the year the price of domestically refined copper was maintained at 24½c., in itself a discrimination widely resented and since abandoned when copper was freed from control. Moreover, price preferences were granted in the case of some marginal producers and various contracts arranged to stimulate new enterprises in which price floors were conceded for some years ahead. Ultimately the N.P.A. allocated copper to all consumers on the basis of 60 per cent at domestic and 40 per cent imported copper prices.

Prices in Britain

In Great Britain the Ministry of Materials maintained a wide premium between so called world export price and their charge to consumers. The Ministry's price at the beginning of the year was £227 per ton (28.275c. per lb.). This was raised at the beginning of April to £231 (28.875c.) and again in the middle of June to £281 (35.125c.). A little earlier the Ministry had announced it would base its selling price on New York quotations plus differentials for freight, etc. Late in June an agreement with producers was announced for a purchase price of 33c. per lb. Then early in July the Ministry's selling price was raised to £287 (35.875c.). At the end of July this was reduced by £2 per ton and remained unchanged till the end of the year. From the beginning of August the Ministry's buying price was raised to 33½c. per lb.

The U.K. consumption is officially given as 571,839 tons against 550,721 tons in 1951, of which 347,646 tons were new metal. Stocks during the period increased from 113,359 to 131,968 tons.

Outlook

Since the new year copper prices like those of most products of the mine have reflected the general easing of all commodities with the easier turn in international tension and the expectation of a relaxation in the armaments race. Copper has been the last of the industrial metals to reflect this price weakening but at the time of writing it has brought the world price down to around 30c.

Considering the sustained industrial activity in the United States and claims by prominent officials that the progress of re-armament, if not entirely satisfactory, greatly improved last year, it may perhaps be a matter of some surprise that a shortage of copper was not more severely felt. As soon as U.S. imports began to increase during the second half of the year the supply situation there steadily improved, but another influence was probably increased use of substitutes and in particular aluminium. Competition in this quarter will certainly develop in view of the prospect that aluminium production will rise rapidly and the assurance thus offered to industrialists of ample supplies, without which large scale planning for substitution is somewhat risky. Aluminium to-day is about two-thirds the price of copper besides being only about one-third of the weight, which means that volumetrically it is less than a quarter of the price. Indeed major concerns like Anaconda are actually preparing to enter the field as producers of the rising new metal. Substitution also made progress in other directions as for instance the employment of steel for ammunition cases in lieu of copper in the United States armament programme.

Moreover, copper production, given an absence of serious labour disturbances, should show considerable increase by the end of the year and much larger ones in 1954-55. Under these circumstances therefore it seems reasonably likely that copper prices in the current year may decline further.

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Tin

By URSEL BALIOL SCOTT

THE year 1952 was characterized by a more stable tin price than we have seen in recent years, fluctuations having been less than £50 either side of the average standard cash price of £964. This stability, which was achieved despite a progressive widening in the gap between world production and consumption, was attributable largely to re-stocking in the United States following the R.F.C. buying strike in 1951.

A welcome event during the year was the resumption in August of the private import of tin into the U.S., although so far the scale of this trade has been limited by the volume of tin entering the States under R.F.C. contract.

Production

As the accompanying table shows, world production in 1952—exclusive of the U.S.S.R.—is put by the International Tin Study Group at 170,500 tons, an increase of 3,000 tons over 1951. Had it not been for a 5,000 ton increase from Indonesia—the only major producer to show an increase—a slight world decline would have been recorded. Malayan output remained virtually unchanged despite a falling off in output from the Chinese controlled mines. Up till now at least, the decline in world output (and more particularly the decline in Malayan output) which some observers have long been forecasting has not eventuated. While it is true that, in the continued absence of successful large scale prospecting, Malayan production must sooner or later taper off, it appears that the Congo's output will eventually be considerably increased as a result of Géomines' major new discovery of tin-tantalum-niobium bearing pegmatites below the existing workings, which are conservatively estimated at several hundred thousand tons and are reported to be workable by open-cast methods.

Géomines, which is currently producing about 4,000 tons of tin annually, expects to be producing 7—8,000 tons by 1956 and at present visualizes an eventual yearly output of 10,000 tons, making it far and away the world's largest tin producer.

Consumption

While production thus remained pretty steady last year, world consumption recorded a further significant contraction; the figures for 1950-51-52 being respectively 148,000 tons, 137,000 tons and 127,500 tons. Over the past three years there has thus been an excess of production over consumption of some 92,000 tons although over the same period world stocks (other than stockpiles) have actually declined slightly and at the end of 1952 were reported from the Hague as being 103,600 tons.

The explanation of these figures lies of course in the U.S.A.'s continued stockpiling of tin. The secrecy surrounding stockpile purchases makes any accurate assessment of progress towards such a target impossible. It was, however, widely believed at the end of 1950 that the U.S. stockpile stood at about 130,000 tons and if we assume that surplus production during the past two years has, broadly speaking, also gone into the stockpile this would suggest that at the end of 1952 it stood at about 200,000 tons, less whatever stocks the R.F.C. were then holding.

Aside from stockpiling, U.S. consumption of primary

and secondary tin in 1952 showed a further substantial reduction over the previous year's figures at 73,348 tons compared with 89,505 tons, and of this total, primary metal production accounted for only 45,299 tons against 56,884 tons in 1951. A clearer picture of the pattern of American consumption should become more apparent in the course of this year, during which the American user will have complete freedom of choice for the first time in twelve years, aside from a short period of freedom from November, 1949—January, 1951. American consumers have, however, got so into the habit of using substitutes in this period of restriction that it may take some time for the pattern of future consumption to emerge.

Consumption of primary tin in the U.K. showed a slight decrease at 22,600 tons compared with 23,900 tons in 1951, despite an increase in consumption in tinplate (which was derestricted in October) at 11,491 tons compared with 9,417 tons the year before.

R.F.C. Contracts

During the early part of the year the R.F.C. concluded buying agreements with the U.K., Indonesia and the Belgian Congo, which very largely set the price for tin for the remainder of the year. Of these, the first—that with the U.K.—as part of the tin and aluminium for steel agreement—became effective only just in time to avert the consequences of the R.F.C.'s prolonged buying

strike in the previous year. It provided for the supply of 20,000 tons at 118c. per lb. (£944 per ton), delivery to be completed by the end of the year. In fact by the middle of March some 5,000 tons had already been shipped. By making this deal with the Ministry of Materials, which in turn re-purchased about two-thirds of the contract tonnage on the Singapore market, the R.F.C. obtained a fixed price contract without interfering with the operation of the Singapore market.

In mid-March the R.F.C. concluded a three year contract with Indonesia calling for the supply of 18,000 tons a year, again at 118c. for the first two years of the contract although the price in the third year was left open to negotiation. Beyond this, Indonesia has the option of selling a further 2,000 tons per annum at the agreed price.

A week later the Belgian Congo contracted to supply 7,000 tons over the next two years with an option to supply 75 per cent of any increased production up to a further 2,000 tons. Approximately 2,000 tons of the quantity delivered is to be in the form of concentrates. The negotiated price was 120½c. delivered U.S. ports; approximately equivalent to the f.o.b. price negotiated with the U.K. and Indonesia.

The significance of the Indonesian and Congo contracts for the immediate future is that the R.F.C. is thereby committed to taking some 30,000 tons of tin in the current year and some 10,000 tons in 1954 at a fixed price.

With satisfactory tonnages in sight from the above contracts the R.F.C. could afford to be in no great haste to conclude a long-term agreement with Bolivia and in fact as we write has not yet done so. So far as is known, no Bolivian tin ore was shipped to the U.S. during the nine months preceding the revolution, and by April some 14,000 tons of concentrates had accumulated in Chilean ports. As things have turned out, the R.F.C. has, in the

MINE PRODUCTION Excluding U.S.S.R. (in thousands of 1,000 tons of Tin)			
	1950	1951	1952
Malaya.....	57.5	57.2	56.8
Indonesia.....	32.1	31.0	35.0
Bolivia*.....	31.2	33.1	31.9
Belgian Congo.....	13.5	13.7	13.3
Thailand.....	10.4	9.5	9.5
Nigeria.....	8.3	8.5	8.3
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course of the past year absorbed this accumulation by piecemeal purchases and has taken up something near its normal quota of Bolivian concentrates at around 118c.

At the end of January this year the new government-owned Bolivian Mining Corporation was stated to have signed an agreement with Williams Harvey covering the sale of the Patiño output at 117c. delivered Chilean ports subject to a sliding scale. Whether this contract is for a fixed period has not been disclosed.

In the East the Indonesian tin mining industry is gradually coming under the control of the Government. Since the end of 1952 it has been reported from the Hague that the Billiton mines, in which the Government hold a majority interest, will continue to be worked by the Billiton Co. for another five years, but that the Banka mines are now completely in the hands of the Government.

In Malaya, 1952 saw some progress in the struggle against the Communist bandits under General Sir Gerald Templar, who was able by the end of the year to announce that in some areas increased geological surveying could be undertaken. Nevertheless, continued guerilla activity made this another difficult year for the industry in which virtually no progress could be made in prospecting. Beyond this, taxation both in the form of export duty, income tax and profits tax has continued to weigh heavily on the industry.

The Smelter Situation

World smelter capacity, which has been estimated at as much as 350,000 tons per annum, is already so much in excess of mine production that the various schemes which were reported to be under consideration last year for the erection of new smelters must, to say the least, appear ill-conceived.

In the States, production at the Texas smelter declined in 1952 to 22,500 tons compared with 30,900 tons the

previous year due principally to a complete shut-down in the summer during a three month strike. In the last three months of the year, however, output averaged around 3,700 tons, equivalent to an annual rate of about 45,000 tons, or about double the average rate at which the smelter had been working during the year. There has again been talk of closing the Texas smelter and alternatively of turning it over to private industry.

The Outlook

As we write, the price of tin has taken a tremendous hammering but so long as the R.F.C. must continue to pay for its contract deliveries at 118c. it seems inevitable that a reaction must set in. Nevertheless, the sensitiveness which the tin market is now beginning to display does underline the state of over-supply from which the industry will no longer be insulated once the R.F.C. contracts, and with them presumably stockpiling, are terminated.

The key to the future must lie largely with the U.S.—by far the industry's biggest customer—and it remains to be seen whether and at what level the States may eventually elect to bolster prices, either by further stockpiling or by supporting some form of international restriction.

The alternative to artificial support of the tin market is of course to allow the free operation of the mechanism of the market, and if this occurs it could well be that once the marginal producers had been shaken out, the price level might not remain so low as the present statistical position might suggest. Moreover if tin was at a more competitive price this would in itself generate increased consumption, although it would remain to be seen just how elastic demand would prove itself to be after so long a period of control and the consequent development of economies in use and the competition of substitutes.

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Lead

THE outstanding feature of lead during 1952 was its sudden transition from a position of apparent scarcity to one of plenty. Notable also was the resumption of trading in lead on the London Metal Exchange.

The year started with an effective U.S. ceiling price of 19c. per lb. and an official Ministry of Materials price of £175 (nearly 22c.). Free market prices continued to be higher than the U.S. ceiling price, a consequence which had led to U.S. imports dropping by over 50 per cent in 1951, and American consumers were consequently very short. To meet essential needs the U.S. Government had, at the end of 1951, made 30,000 tons available from the stockpile, about 60 per cent of which was actually allocated to consumers, and early in February Congress approved a Bill suspending the import duty of 1½c. on imported lead as long as the price remained at, or above, 18c.

Easing Free Market Boosts U.S. Imports

Yet side by side with these emergency measures in the States, prices on the free market were already sagging, consequent on the 1951 slump in U.S. imports and a slowing up of European buying. The repercussions of this on the American market came rapidly and as early as February the primary lead producers were urging the N.P.A. to revoke the allocation of foreign supplies and were wanting to discuss the suspension of domestic allocation. Nevertheless, between the beginning of February and the end of May the Ministry of Materials sold 53,000 tons to the U.S., part of which presumably went into the stockpile.

Under this pressure of growing stocks the U.S. price broke at the end of April and within a fortnight had fallen from 19c. to 15c., subsequently hardening to 16c., where it remained till London trading commenced.

Following the American price break N.P.A. lifted inventory controls, thus enabling trading in lead futures to be resumed in New York. In July it became possible to reimpose the import duty, and at about the same time it was officially announced that D.M.P.A. would buy 30,000 s.tons over the remainder of the year to be held as a low price reserve for resale to consumers, or if not required by the year end to be transferred to stockpile.

Meanwhile the Ministry of Materials price remained above the U.S. price and substantially above the Continental free price throughout the early part of the year. Even so, the Ministry price was down to £129 per ton by the end of May.

Re-opening of Metal Exchange

At the beginning of August the Ministry of Materials was able to announce that dealing in lead would be restored to private hands. Hitherto this long awaited development had been held up through fear of hard currency losses, but the development of an unfavourable E.P.U. balance of payments during the summer meant that even if dollar lead had to be purchased for resale to Europe, this would be no worse than having to ship gold to adjust the adverse E.P.U. balance. Additional incentive must have been provided by the embarrassing growth in volume, and depreciation in value, of the Ministry's stocks which in August stood at over 100,000 tons.

Dealings on the Metal Exchange were resumed on October 3, opening price being £107 per ton—some £20 below the then U.S. level of 16c. Within three weeks the price had drifted down to £80 carrying the U.S. price with it to 13½c. A statement by the Ministry of Materials at the beginning of November clarifying its policy as to the disposal of its lead stocks helped to strengthen the market and the London price settled down in the £90's for the last two months of the year, briefly going to £108 at the

year end. (Since the year end we have, of course, seen lead down to below £75.)

Although no precise U.K. stockpile figures have been published it seems probable in the light of the Ministry of Materials' November statement with regard to its stocks that the 95,000 tons held by the Government at the re-opening of the Metal Exchange were eventually disposed of approximately as follows: sold through the Metal Exchange, 12,500 tons; resold to producers, 27,500 tons; stockpiled, 55,000 tons.

Total consumption of primary lead in the U.K. during 1952 amounted to 194,650 tons compared with 232,122 tons in 1951, and at the year-end apparent total stocks amounted to 75,510 tons including 50,000 tons of Government metal.

Supply and Demand in the U.S.A.

In the U.S.A. mine production decreased slightly in 1952 to 384,097 s.tons (compared with 388,164 s.tons in 1951). This was the lowest figure since 1946 mainly due to a number of shut downs towards the year end consequent on lower prices. Secondary lead was also down by some 50,000 s.tons at 470,000 s.tons. Imports on the other hand were much increased amounting in all to some 628,000 s.tons (compared with 258,000 s.tons). There was thus an overall increase in supplies of some 315,000 s.tons against which consumption on the year was down by 60,000 s.tons at 1,122,000 s.tons while producers' and consumers' stocks together rose by some 40,000 s.tons on the year. This leaves 300,000 s.tons unaccounted for, which, it must be presumed, has found its way into the stockpile.

In November, Mr. Larson, then head of D.M.P.A. and G.S.A., issued a further statement that there was actually no surplus of production and that unless production of both lead and zinc could be maintained at the level prevailing before the price declines serious shortages would develop in 1953. Concern at increasing shut-downs in mines unable to compete with low priced imports, led to the formation in December of a National Emergency Lead-Zinc Committee comprising the majority of U.S. producers. This Committee has sponsored a drive to obtain Federal legislation providing for a sliding equalization tax on lead imports which would increase as the export price fell, an import duty ceiling of 5c. having been suggested.

Certainly such a development could scarcely be in sharper contrast to the conclusions of the Paley Report which has emphasized the U.S.A.'s growing dependence on foreign lead supplies.

World Output

Complete world mine output figures for the year are not available as we write, but of the principal producing countries, other than the U.S.A., Australia appears to have recovered the 5 per cent drop it experienced in 1951 and last year produced around 223,000 tons assisted in part by a sizeable increase in Western Australian production. The Canadian output amounted to 165,000 s.tons compared with 152,000 s.tons. Although Mexico seems to have suffered some decrease at 246,000 tons (262,000) South and South-West Africa on the other hand have reported a substantial increase at 44,520 tons (34,200) as did Morocco with a total of 115,000 s.tons (93,000). Peruvian mine output was expected to reach 180,000 tons last year and may be up to 100,000 in a few years, thanks to big increase by Cerro de Pasco. Yugoslavia also reports an increase of 67,500 tons (60,000).

On balance it therefore seems probable that the Free World output increased last year—perhaps by as much as 50,000 tons.



Non-Ferrous Link around the Globe

One of the many industrial bands that link Great Britain and the Commonwealth, The Consolidated Zinc Corporation unites the activities of Imperial Smelting Corporation Ltd. of Britain with The Zinc Corporation, Ltd. of Australia.

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Zinc

SO far as figures are available it would appear that world mine production of zinc in 1952 increased by some 150,000 tons over the previous year. This, no doubt, was due mainly to the exceptionally high price which had been ruling for zinc since the commencement of the Korean war.

Mine production for the principal producing countries, excluding the U.S.S.R., is given in the accompanying table. The figures are mainly those of the American Bureau of Metal Statistics. On the smelter side of the picture, the A.B.M.S. puts world slab zinc production, including output from secondary metal, at 2,141,000 s.tons an increase of 76,000 tons over 1951. These figures exclude Iron Curtain countries, Yugoslavia and the Argentine.

Broadly speaking the picture presented by zinc during 1952 was one of initial apparent shortage and consequent high price largely brought about by U.S. stockpiling, which gradually, and by mid-year rapidly, changed to one of substantially lower price and apparent superfluity.

The U.S.A.

The year in the States opened with zinc at 19½c. where it remained till the end of May and then in the space of three weeks the price broke 4½c. to 15c., thereafter gradually receding to close at 12½c.

According to the U.S. Bureau of Mines, domestic production was about 3 per cent down over 1951 at 661,000 s.tons while imports of ores and concentrates totalled 450,500 tons against 303,000 tons. Smelter production was about 3 per cent up on the year at 961,200 s.tons, the highest figure achieved since the record output of 1943, while the excess of slab zinc imports over exports totalled 69,200 tons against 51,500 tons. There was thus 1,020,400 tons available for consumption against an actual consumption estimated at 849,300 tons (a decrease of 9 per cent), leaving an apparent excess of production amounting to about 171,000 tons. Of this, 106,000 tons is reflected in increased smelter and consumer stocks over the year, leaving some 65,000 tons unaccounted for, much of which must have gone into the stockpile.

The import duty was suspended on February 12 but was re-imposed at the beginning of August.

The United Kingdom

In Europe the Continental price which was as high as £250 per ton early in the year had fallen to £155 at the beginning of May and to somewhat below £90 at the beginning of 1953. The Ministry of Materials' selling price began the year at £190 per ton and by the beginning of May was substantially above both the Continental and U.S. prices and remained so till the end of the year. The Ministry price then fell about £60 during May and the first half of June and from there gradually eased to a year-end price of £110 dropping a further £20 during the first week's resumption of London Metal Exchange trading in January of this year.

As a result of the substantial Ministry contracts placed with Dominion producers in 1951, imports of slab zinc during 1952 nearly doubled at 229,000 tons, while domestic production decreased by about 1,000 tons to 68,700 tons and consumption was about 10 per cent down at 170,900 tons. Government and consumers stocks together consequently rose over the year from 39,700 tons to 166,000

tons. On August 20, controls on the use of zinc in the U.K., other than in copper and copper-based alloys, were removed.

The resumption of zinc trading, which had been fore-shadowed by a Government announcement in October, did not suffer from quite the same violent fluctuations as had occurred in the case of lead, as in this case the Ministry announced in advance its intentions with regard to its stock disposal—namely to resell a given tonnage to producers and otherwise to withhold its stock from the market except insofar as the Government broker might be required to supply spot metal.

On the other hand in the case of zinc the Ministry was confronted with a very much larger stock disposal problem. Moreover, the greater variation in brands coupled with the weaker statistical position of the metal made it that much more difficult to resell stocks to producers, and in the event, agreement has only been reached to sell back

about 24,000 tons to producers over the first half of this year out of Government stocks totalling about 150,000 tons.

The Outlook

A key factor in world smelter production is that out of some 20 producing countries only six normally have an available export surplus, namely, Canada, Belgium, Mexico, Australia, Norway and Rhodesia to which may soon be added the Congo, Yugoslavia and Peru. These six countries usually export around 500,000 tons (say 20 per cent of world pro-

duction), and it is this amount only which actually constitutes the international slab zinc market. This must tend to accentuate price movements each time consumption fluctuates and stocking policy veers with the economic outlook.

This situation has a special importance for the zinc mining industry in view of the considerable elasticity which exists in the demand for zinc. This was well illustrated during the past year when the U.S. consumption of zinc in zinc based alloys (the second most important outlet in America) declined 20 per cent to 236,000 tons, partly as a result of the price disadvantage at which zinc was placed during late 1951 to early 1952 in relation to aluminium. Since then the advantage has again swung heavily in favour of zinc and we may expect to see a considerable increase in zinc alloy consumption this year. Similarly, with the easing in steel supplies throughout the world usage among galvanizers (who suffered considerably last year in the U.S. as a result of the steel strike) should also increase. These factors coupled with the incentive to restock which is afforded by the present low price which is at the same time closing down many marginal producers, makes it probable that we shall see zinc higher rather than lower in the months ahead.

Up till now the large expansion in use of zinc in alloy die-casting has been primarily a feature of the American scene and a similar expansion in Europe has yet to come. Indeed, European consumption of zinc as a whole, which has been estimated at 678,000 s.tons in 1952 was over 20 per cent down on the 1938 figure, whereas U.S. consumption which according to the U.S. Bureau of Mines totalled 849,000 s.tons increased by over 50 per cent in the same period. Some of the European decrease may be accounted for by loss of German plant during the war, but even so it is clear that Europe is lagging behind America in her expanding use of zinc.

MINE PRODUCTION FROM PRINCIPAL COUNTRIES

excluding U.S.S.R.
(000 s.tons)

	1950	1951	1952
U.S.A.	623	679	661
Canada	313	334	367
Australia	186	179	233
Mexico	201	197	228
Peru	97	112	122
Belgian Congo	82	98	97
Italy	78	94	98
Japan	57	71	95
Germany	76	80	89
Spain	70	79	85

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The London Metal Exchange

THE period under review, writes our Metal Exchange Correspondent, has been one of the most important in the history of the London Metal Exchange, as it saw the re-opening of the lead market on October 1, 1952, the re-opening of the zinc market on January 1, 1953, and the first preparations made for the re-opening of the copper market. At the same time the tin market suffered through the activities of foreign merchants who, by the use of transferable sterling, were able temporarily to force old-established London firms out of one of the major parts of their business—tin shipments from the East to the U.S.A.

In spite of the many difficulties to be overcome, especially those connected with the re-establishment by individual members of a metal exchange section staffed with men competent to undertake the dealings on the Exchange itself, it can be claimed that the Metal Exchange is once more regaining its position as the leading market in the world.

During the early part of 1952 the tin market was dominated by the abnormal American demand which arose consequent upon the R.F.C.'s long period of refusing to purchase tin at world prices, and later (after the return of the importing trade into the U.S. to private firms) by the R.F.C.'s policy of being a seller at the fixed price of 121½c. per lb., which had the effect of keeping the market at this level until April, 1953, as up to that time demand had always been in excess of tin available from private sources. The price of tin in Singapore throughout the year was governed by the American quotation converted at the ruling rate for transferable sterling, less charges for shipping from Singapore to the U.S. with transshipment in Europe. The London market has been largely domestic.

Lead and zinc have seen a complete turnabout in availability, as at the beginning of 1952 the U.S. was an anxious

buyer of both metals, and a new Bill continuing the suspension of import duties was passed in February of that year. However, by June in the case of lead and July in the case of zinc, offerings from abroad had forced the previous month's price to such a level that the duties were automatically reimposed.

In the U.K. the opening of the market for lead caused a sharp fall in price, which was arrested when the Ministry altered its method of selling outside market hours, and announced that owing to substantial sales to the American stockpile only about 9,000 tons were left for sale in the Ring. The price then rose sharply, and the subsequent decline was lessened by sales of Australian lead to America and by the strike at Port Pirie, which, coinciding with the final disposal of the Ministry's stocks, gave rise to an appreciable backwardation during the first months of 1953.

The opening of the market for zinc caused a continuous downward movement in price during the whole of the first quarter of 1953, which was due to normal commercial factors, as after heavy sales on the first few markets the Ministry sold only extremely small quantities.

The outlook for metal prices is obscure and to a large extent dependent upon the political atmosphere, but the following factors should not be ignored. In the case of tin the Bolivians have half their output to sell, but the production in Malaya may start to decrease owing to interference with prospecting. In the case of lead and zinc the price levels which existed at the beginning of April, 1953 were already causing the closing down of some minor productions, but as very little data is available on actual post-war production costs, some time will have to elapse before it becomes evident at what price those larger producers who provide world marginal requirements will close down.

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Aluminium

By A. GRAHAM THOMSON

IN 1952, world production of aluminium established a record at about 1,950,000 s.tons as is shown in the table below. U.S. reduction plants established a new primary production record of approximately 937,000 tons, and but for substantial production losses suffered because of power shortage in the north-west due to drought, this figure would have been substantially greater. The Canadian output was 45,000 tons higher and approached 500,000 tons. The American price having remained at 19c. for nearly two years, rose to 20c. at the beginning of last August and there has been a further increase since the turn of the year to 20½c.

The D.P.A.'s revised production capacity target is now in the region of 1,700,000 tons per annum, or almost exactly double U.S. production in 1951. The most recent increase of 200,000 tons was ascribed largely to the Munition Board's upward revision of stockpile requirements. Taking this in conjunction with the doubling of Canadian output as envisaged in Alcan's Kitimat scheme, together with the possible eventual output of some 200,000 tons from the Volta River, as well as a number of lesser expansion programmes in other parts of the world, it is hardly surprising that towards the end of last year it seemed to some that the industry's productive capacity was threatening to outstrip the rate of expanding demand.

The Outlook

The long-term prospect—so far as this could be accurately forecast—still seemed fair enough, with the Paley Report forecasting a Free World consumption of 6,000,000 s.tons by 1975 — an estimate which has received some confirmation from the president of Alcan's U.S. subsidiary, the Aluminium Import Corporation, who has put consumption by 1960 at over 3,000,000 s.tons. In the last analysis, however, the key to the future of aluminium, as of any "young" metal, lies to a considerable extent in the development field; that is to say, in the extent to which, either for price or technological considerations, it will replace traditional materials such as copper or steel.

It was rather in the short-term prospect, however, that there appeared to be some danger of over-production. Certainly there was no sign of this in the U.S.A., during 1952, where the drought, coupled with heavy military requirements effectively prevented any increase to the stockpile, despite emergency import measures such as the U.K. aluminium loans. Nevertheless, some American aluminium producers do seem to feel that over the next few years equilibrium between probable military plus civilian consumption and rapidly expanding production must depend largely on continued heavy stockpiling.

Situation in the U.K.

Meanwhile the recent picture in the U.K. has been less cheerful, and during the latter part of the year a marked recession developed with several fabricators going on short-time, in part as the result of a running down of consumer stocks as the world position became easier, and in part owing to a falling off in exports—this latter being the more serious factor. Both, however, should prove to be short-term difficulties. During 1951, the British Ministry of

Supply was able to keep the price of aluminium unchanged, but during 1952 it rose from £124 to £166 a ton. Government bulk purchasing and distribution of ingot metal continued throughout the year, although as we write there is news of negotiations which may lead to a return to private trading.

Alcoa's Year of Expansion

During 1952, Alcoa began production of primary aluminium at two locations and placed augmented smelting facilities in operation at another. The first half of the new 85,000 s.ton Alcoa plant at Wenatchee, Washington, is now producing metal. Production was also started at the company's Rockdale (Texas) Smelting Works, where lignite will eventually be used for fuel to generate the required electric power for aluminium production. This plant will also produce 85,000 s.tons annually. Alcoa's existing plant at Point

Comfort, Texas, placed 35,000 s.tons of additional capacity in operation last year. This expansion of smelting facilities has been accompanied by important additions to the company's alumina plants and bauxite facilities.

Other U.S.A. Plans

Another new smelter to start production last year was Reynolds' Corpus Christi plant, with a capacity of 75,000 s.tons per year. Further increases in U.S. smelter capacity aggregating 374,000 s.tons are due in 1953-54. They include 55,000 s.tons more from Reynolds' new Arkansas plant, 5,000 tons more at Corpus Christi, 100,000 tons at Kaiser's Chalmette plant (bringing capacity

up to 200,000 tons), and a production of 50,000 tons per year from Anaconda's Montana plant.

Two newcomers under the Administration's "third round" of primary aluminium expansion, Olin Industries and Harvey Machine Co., are entering the industry with projected capacities of 110,000 tons and 54,000 tons respectively. In addition, a 50,000 s.ton capacity plant is to be constructed by the Wheland Co. of Chattanooga, bringing the number of basic aluminium producers to seven.

It is perhaps pertinent to point out that the emergence of the "third round" expansion programme represents a Washington victory for those who favour the maximum development of U.S. domestic production capacity rather than the encouragement of more rapid Canadian expansion. The wisdom of this policy remains to be demonstrated. U.S. hydro-electric resources are already fully utilized and vulnerable as the recent drought has shown. As the country's economy becomes further expanded—more particularly in the event of war—it seems likely that some hydro-electric capacity will of necessity be switched to other essential purposes necessitating either increased Canadian imports or uneconomic domestic production from high-cost power.

Alcan to Double Output

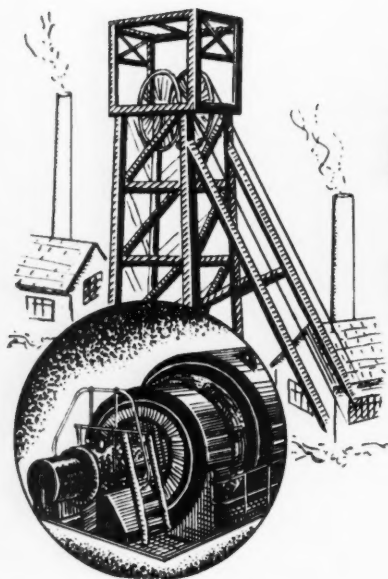
By the end of 1952 the metal producing capacity of the Aluminium Ltd. group had been increased to 495,000 tons annually through expansion at the company's smelter at Arvida, Quebec. In 1953, another 45,000 tons will be added to Arvida's capacity. By the end of last year Alcan had virtually completed a new hydro-electric plant with an

PRIMARY PRODUCTION

Excluding U.S.S.R. and satellite countries
(in thousands of short tons)

	1950	1951	1952
U.S.A.	719	837	937
Canada	396	447	500
France	67	100	117
Western Germany ...	31	83	111
Italy	41	55	57
Norway	51	55	57
Japan	27	41	47
Austria	13	29	43†
U.K.	33	31	31
Switzerland	21	30	29
All other countries	8	20	20
TOTAL	1,407	1,728	1,949

† Based on Jan.-Oct. production.



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installed capacity of 270,000 h.p., and a second hydro-electric plant of similar capacity on the Peribonka River will shortly be completed. Substantial progress was made in the construction of the \$555,000,000 plant at Kitimat, 400 miles north of Vancouver, which will have an eventual capacity of 500,000 s.tons (see *M.J.*, October 17, 1952). This integrated development is scheduled to add some 90,000 tons to existing capacity in 1954. For further information on Aluminium Ltd. and its subsidiaries, see page 221.

New Bauxite Operations in Jamaica

Bauxite mining is being stepped up as required to meet the D.P.A.'s revised target namely a total U.S. supply of 8,000,000 l.dry tons. This has further stimulated interest in the Jamaican deposits. The official opening of bauxite mining operations at Ocho Rios by Reynolds Jamaica Mines Ltd. took place early in 1952.

The name of Jamaica Bauxites Ltd.—the Alcan subsidiary—has been changed to Alumina Jamaica Ltd. Since early last year this company has been engaged in the construction of a plant from which production at the rate of 66,000 tons of alumina per annum from crude bauxite is about to begin.

Kaiser Bauxite Co., the Jamaican subsidiary of Kaiser Aluminium & Chemical Corporation, have started mining operations on 19,000 acres of bauxite reserves with an annual capacity of approximately 2,000,000 tons. The British Aluminium Co. was reported to be exploring bauxite deposits about 20 miles from Kingston.

The Federal Government of Australia has decided to spend a further £A.3,000,000 on completing the aluminium plant at Bell Bay, Tasmania, which is expected to make the first ingots early in 1954. At least 1,000,000 tons of bauxite have been proved in Victoria and could be won

easily and quickly to supply this project. Very large bauxite deposits were recently discovered in three sites in Arnhem Land in the Northern Territory.

The Volta Scheme

During the year the Volta River aluminium project for the Gold Coast was carried a stage further with the publication of a White Paper on the scheme. If finally approved, this project envisages an eventual annual ingot capacity of 210,000 s.tons (see *The Mining Journal*, December 5, 1952).

French aluminium producers have been able to resume exports to traditional markets owing to the improved supply position. Primary output last year was 106,000 tons, compared with 91,103 tons in 1951, and secondary supplies were expected to reach some 20,000 tons. Electricity costs are the main obstacle to further expansion in French production and hopes are now concentrated on the possibility of establishing an aluminium industry in French Guinea.

In 1952, Norway produced 51,700 tons of aluminium. The new aluminium plant at Sundalsora, West Norway, to produce 40,000 tons a year, will be ready in 1954/55. Austria's Vereinigte Aluminiumwerke produced 31,000 tons in 1952 (21,300 tons in 1951). This country's other aluminium plant—in Lend, Salzburg—has an output of some 6,000 tons. West German production of aluminium in 1952 was 100,000 tons and very little had to be imported.

Yugoslavia announced plans to produce 22,500 tons of crude aluminium by 1954 and to raise output further to 37,500 tons by 1956. The present output comes from smelting works at Lozavac with a capacity of about 3,000 tons of crude aluminium yearly. New processing plants financed by a loan from the International Bank will make it possible for Yugoslavia to produce additional tons of alumina and 15,000 tons of aluminium.

Consult
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Magnesium

THE progress of magnesium has been further accelerated by rearmament and its increasing use for low stressed aircraft components and transport generally. As the lightest structural material (aluminium is $1\frac{1}{2}$ times and titanium $2\frac{1}{2}$ times heavier) the potential usage of magnesium is vast, but this expansion still largely awaits the research metallurgists' solution to the problem of providing adequate protection of the magnesium alloys against corrosion.

Excess U.S. Production?

U.S. production of primary metal has been planned to increase tenfold in three years, from 15,726 s.tons in 1950 to a rate equivalent to 145,000 tons per annum by early 1953, of which 100,000 tons will be Government produced. The 1952 output was 105,833 s.tons compared with 40,800 s.tons in 1951. The U.S. Government decided in 1951 to give no further aid to domestic private producers. Current U.S. consumption is estimated to be at the rate of 45,000 s.tons per annum. The D.P.A. has recommended the closing of two out of the six high-cost Government owned plants which were taken back into production in the middle of 1951 in the belief that, even without these, production is now sufficient to meet all requirements, including stock-pile targets. (Latest news is that all but one will close.)

Canadian output figures are not published. However, plans have been announced by the Aluminium Co. of Canada to raise magnesium metal production at its Arvida, Quebec, plant from 3,000 to 4,000 tons per year. In return for a loan of \$2,200,000 towards the capital cost of this expansion programme, the Canadian company has undertaken to supply 2,640 tons of magnesium a year to the

U.K. over 20 years, beginning in 1954. Dominion Magnesium continued to operate at capacity during 1952.

Position in the U.K.

Last year the U.K. imported about 3,400 tons of ingot magnesium, the bulk of this coming from Canada and the U.S.A., while domestic production reached some 2,550 tons obtained from the reduction of magnesia produced from the sea water process. While it has not been possible at the time of writing to ascertain exact consumption, it was probably in the neighbourhood of 4,850 tons. Control on the acquisition and use of virgin magnesium, imposed in the middle of 1951, continued throughout 1952.

The delivered price of the ingot metal on February 1, 1952 rose from 2s. 4½d. to 2s. 10½d. per lb. in line with an increase in the import price. Even so the cost of substantially increasing domestic production would be in excess of the import price, owing to the relatively high cost of the electric power required for the electrolytic reduction process. It was owing to this factor that the various war-time plants had been closed down by 1947 following the withdrawal of Government financial support and for the next four years domestic users existed on accumulated stocks plus imports. Then in 1951, as a result of rearmament demand, Magnesium Elektron Ltd. restarted one of its electrolytic plants, at the request of the Government, and is at present the sole domestic producer.

The Japanese, whose needs can no longer be met from imports, are restarting their own high-cost production of magnesium metal. A Norwegian plant is expected to produce 5,000 tons in 1953.

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Titanium

BECAUSE of its low density, high strength and exceptional resistance to corrosion, titanium can become the basis of a very large metallurgical industry. At present the limiting factors are the high cost of the metal and its alloys and lack of technical knowledge. One of the foremost requirements is an economical process for large-scale production. Further progress was made last year in both development and research. Government and commercial laboratories in Britain and the U.S. were engaged on titanium research. The thermodynamics of certain titanium compounds were studied at the National Physical Laboratory to assess the possibilities of developing cheaper methods of reduction and the effects of impurities arising from the various reduction processes were investigated.

Wrought titanium products were shown for the first time by I.C.I. Ltd. at the British Industries Fair in 1952. It was subsequently announced that I.C.I. were to begin the erection of pilot plants in Britain for the production of wrought titanium and its alloy as part of a three-year research and development programme.

Growth of U.S. Production

Rapid strides have been made in the expansion of U.S. production. A capacity goal of 22,000 tons of titanium has been set by D.P.A. for 1955. Rem-Cru Titanium Inc., one of the major producers of titanium metal, has started on a production plan which will more than double its capacity. In 1952 it produced titanium and titanium base alloys at a rate exceeding 10 tons a week. New melting facilities installed at its plant at Midland, Pa., have raised ingot sizes to a range of 2,000 to 4,000 lb. The production of commercial sponge in the U.S. last year was estimated at 1,100

s.tons, or approximately double the 1951 output. An agreement with E. I. du Pont de Nemours to triple this company's output of titanium over the next five years has been signed by the D.M.P.A. The production target is some 13,500 s.tons. A similar agreement between the U.S. Government and the Titanium Metals Corporation provides for the production of 18,000 tons of titanium sponge over a five-year period. The National Lead Co.'s Henderson, Nevada, plant was expected to reach ten tons of titanium a day by the end of 1952.

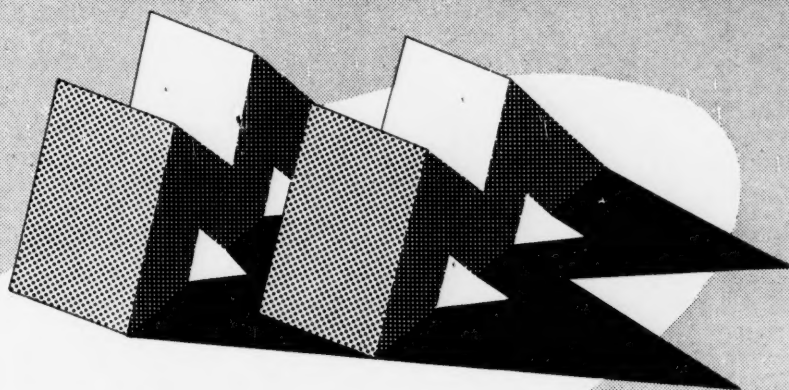
New Industry For Japan

A titanium industry is regarded as one of Japan's most hopeful enterprises. Last year it was only at the experimental stage, but a production of over 500 tons of titanium was anticipated during 1953. The Glidden Co. has undertaken to provide technical assistance for the large-scale production of titanium dioxide in Japan.

In Canada, production of titanium by the Quebec Iron & Titanium Corporation is now 150,000 tons of processed ore annually and will reach 300,000 tons when a new refinery is completed at Sorel near Montreal. Last year the corporation's output of titanium slag amounted to 37,626 tons. Titanium ores have been discovered in substantial quantities near Baie Verte, White Bay, on the N.E. coast of Newfoundland, where ilmenite concentrates appear in large quantities in an area of four by 1½ miles. A smelter will be erected at a cost of \$500,000. The Terrebonne Titanium Co. has started operations 55 miles from Montreal.

India and Australia remain the main sources for ilmenite and rutile. Australia has undertaken to carry out special research for Britain on the use of titanium in alloys.

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Asbestos

BROADLY speaking the asbestos boom continued during 1952 although at a somewhat diminished tempo. Output by last year had to a considerable extent caught up with demand with the result that buyers could afford to be, and were becoming, more selective as to the types and grades they were willing to buy to gear in to their particular manufacturing processes. This tendency to buy to tighter specifications reacted more particularly on the small producers who had been brought into the market by the earlier boom years and were not fully equipped to meet quality competition. This seems to have been especially true of the trade in South Africa which in recent months is reported to have been suffering something of a recession; although a further contributory cause was a sharp falling off in exports to the Argentine and Brazil due presumably to currency difficulties. It is also rumoured that the U.S.S.R. has re-entered the market, although what effect this may have had is not clear.

African Production

Notwithstanding South Africa's year-end difficulties, her sales output for 1952 of all grades together rose to about 123,000 s.tons compared with 102,000 s.tons the previous year. Chrysotile increased by over 10,000 tons to 24,680 tons selling at an average of about £95 per ton; amosite accounted for 58,032 tons averaging around £38 per ton, while Cape and Transvaal blue together totalled 40,954 tons averaging around £78 per ton.

In Southern Rhodesia the asbestos boom continued throughout the year and for the first time asbestos achieved a bigger output value than gold. The output of chrysotile totalled 84,834 s.tons against 77,663 s.tons in 1951.

In Swaziland, Turner & Newall's Havelock mine has been producing around 30,000 tons a year.

The World's Largest Producer

Canada, by far the world's largest producer of asbestos, had an output of 966,382 s.tons of chrysotile, a slight decrease on the previous year's output of 973,198 s.tons.

Johns-Manville alone are producing over 500,000 tons a year at Asbestos, Quebec—more than a third of the world's output. This Corporation also holds a controlling interest in Rhodesian Asbestos Ltd., formed at the beginning of 1952 to develop properties in the Mashaba area in Southern Rhodesia. Total ore reserves are believed to exceed 500,000 tons of fibre of all grades with an average value of £60 per ton.

The Asbestos Corporation's mines at Thetford, Black Lake and Vimy Ridge operated at about the same capacity as in 1951. At Vimy Ridge a vast new ore body is being developed involving about \$10,000,000 worth of plant which is eventually planned to yield about 5,000 tons a day. A similar rate of output is projected for Black Lake by the United Asbestos Corporation, a subsidiary of A. S. & R.

U.S. domestic production last year totalled around 51,000 tons compared with imports which were in the neighbourhood of 625,000 s.tons. In contrast to the position in S. Africa the American market remained notably strong throughout the year, shortages being particularly acute in groups I to IV.

Imports of raw asbestos into the U.K. during 1952 totalled 128,387 tons compared with 122,290 tons in the previous year. The principal sources were S. Rhodesia with 45,446 tons, Canada with 44,666 tons and South Africa and Swaziland which together supplied 35,669 tons.

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Antimony

AT the beginning of 1952 production and consumption of antimony were approximately in balance, but a definite slackness in new buying could be discerned. This radical change in supply was due largely to high prices which stimulated production expansion.

Falling Prices

The high level of production resulted in the liquidation of accumulated inventories and led to falling prices. Another factor which made for weakness in the market was the completion during the year of the U.S. stockpile objective for antimony, believed to be in the neighbourhood of 20,000 tons of primary metal. By June 18, a succession of price cuts had reduced the price of 99 per cent regulus in the United Kingdom to £225 per ton, compared with a peak of £390 a ton in June, 1951.

In consequence of the depressed prices production ceased to be economic at many mines and was drastically curtailed.

Of the principal producing countries, South Africa reports a sharp fall in sales at 11,229 tons, compared with 28,211 tons in 1951, while Bolivian exports declined by 1,000 tons to 8,572 tons. Mexican output is not known at this writing, but was probably again in excess of 5,000 tons.

U.S. domestic mine production fell to 2,000 s.tons of antimony compared with 3,512 tons the previous year and smelter production was about 11,000 tons against 12,228 tons in 1951. The Bradley Mining Co., Stibnite, Idaho, which used to account for more than 90 per cent of the U.S. domestic production, temporarily discontinued mine production in June, 1952, and its smelter was shut down in August. Net imports of primary antimony averaged about 1,000 tons a month, 86 per cent of which came from three countries—Bolivia, Mexico and South Africa.

U.S. industrial consumption during the year totalled 14,075 s.tons compared with 17,519 tons in 1951.

In the U.K., normally the second largest Free World consumer, total consumption of antimony metal fell to 3,168 l.tons in 1952 compared with 6,272 tons the previous year.

Due to delays in reopening mines closed or on reduced output, the outlook for adequate Free World supplies during 1953 is not regarded as favourable. A further production decline is anticipated in Bolivia, because of economic and political troubles, while Mexican production has been declining on account of the gradual exhaustion of higher grade ore deposits suitable for hand sorting.

However, Yugoslavia's output of antimony ore during January-August, 1952, averaged 6,391 tonnes per month compared with a monthly average of 4,684 tonnes in 1951. The production of antimony regulus in Yugoslavia was raised from the pre-war rate of 1,500 tonnes to 1,815 tonnes in 1950, but fell by a third in 1951 and was increased comparatively little last year. New flotation plants are under construction to supplement the two in existence.

Will Stockpile be Increased?

In view of the low U.S. self-sufficiency and the deterioration in the Free World supply of antimony, members of Congress and members of the industry have urged that the antimony stockpile goal should be increased in the interests of national security. Strong support for this proposal is contained in the Paley Report, according to which U.S. consumption of antimony is likely to increase by 75 per cent between 1950 and 1975, while the rest of the Free World may consume twice as much antimony in 1975 as in 1950. The estimated world reserves are 3,500,000 tonnes of contained antimony, 2,000,000 tonnes being in China.

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Nickel

By A. GRAHAM THOMSON

THE accelerated expansion of existing production facilities and the advent of new and potential producers were the highlights of the nickel industry in 1952. Dr. John F. Thompson, chairman of the International Nickel Co., estimated the Free World output of nickel last year at about 157,500 s.tons, representing an increase of some 10,000 s.tons over the 1951 total and of 75,000 s.tons over pre-war output.

The gradual improvement resulting from increased production was reflected by I.M.C.'s allocations of nickel, which rose from 33,600 tonnes in the first quarter of 1952 to 37,049 tonnes in October/December, and 37,272 tonnes in the first quarter of 1953. The U.S.A. and U.K. respectively received 25,013 and 5,433 tonnes of this latter allocation. Despite this improvement, supplies are still inadequate to meet large U.S. stockpile objectives simultaneously with unrestricted civilian uses and the requirements of defence programmes.

Early in the year D.M.P.A. announced that the U.S. was planning for a 1954 supply of 132,000 s.tons, representing a 31 per cent increase over the 1950 total. Of this planned increase about 30,000 tons was expected from facilities in other countries, particularly Canada and Cuba, U.S. domestic production for 1954, being expected to reach 1,400 tons. By the end of the year, however, D.M.P.A. had again greatly increased its supply target for 1954 which now stands at 190,000 s.tons.

Canada's Dominant Output

Canadian output in 1952 was about 140,000 s.tons or some 90 per cent of the total Free World output. International Nickel's production fully maintained the current yearly rate of approximately 125,000 s.tons refined nickel. The company's underground mining expansion in the Sudbury district is scheduled for completion next year. This will give Inco an annual capacity of 13,000,000 tons of ore entirely from its underground operations.

Early last year the D.M.P.A. agreed to purchase 25,000 s.tons of nickel from Falconbridge over the next nine years, as well as 1,500,000 lb. of cobalt, and it obtained an option during the life of the agreement to purchase 12,500 s.tons of copper and an additional 12,500 tons of nickel. Since the end of the year a new contract has been negotiated increasing D.M.P.A.'s purchase of nickel to 50,000 s.tons by June, 1962 at current market price plus an amortization allowance. Cobalt and copper purchases are also to be greatly increased. Falconbridge has undertaken that, until the end of 1956, not less than 40 per cent of its entire production of nickel and cobalt will be offered to the American market. Falconbridge is engaged on a development programme, financed in part by the U.S. Export-Import Bank, designed to give the company an annual capacity of 17,500 s.tons in 1954.

The Falconbridge refinery at Kristiansand, Norway, was changed over to the chloride process in March, 1952. Following the completion of a three-year expansion project, this works has increased output by about 50 per cent. Last year's output was expected to reach 14,000 s.tons.

Construction was started in May on the refinery of Sherritt Gordon Mines Ltd., Canada's important new nickel mine at Fort Saskatchewan, Alta, which is scheduled for completion in December, 1953. The annual production planned is 8,500 tons of nickel, 4,000 tons of copper, and 150 tons of cobalt. D.M.P.A. has entered into contracts to purchase 65,000 s.tons of ore from East Rim Nickel and 4,104,000 lb. from Milnet Mines Ltd. In each

case the ore will be mined in the Sudbury district and processed by Falconbridge in Canada or Norway.

Production Elsewhere

The acuteness of the nickel shortage was indicated by the anxiety of the U.S. Government to re-open the Nicaro plant in Cuba, to which materials were flown. When worked during the war it had a capacity of about 16,000 s.tons of nickel oxide yearly. In September it was announced that this plant was again in full operation with a capacity of 15,000 s.tons. Since then it has been stated by D.M.P.A. that plans are in hand to increase the Nicaro production by a further 75 per cent. Operation is by the Nickel Processing Co., in which National Lead holds a 60 per cent interest.

In French Caledonia, currently producing 7,000 s.tons of nickel per annum, refineries are being modernized.

The U.S. has also turned to a French company and a French process in an effort to expand supplies. Disclosing a huge project to exploit domestic deposits of nickel-bearing ore from a large mountain deposit in south-western Oregon, D.M.P.A. stated that ingots of ferro-nickel would be produced under a patented process developed by the Société d'Électro-Chimie d'Électro-Metallurgie et des Acieries Électriques d'Ugine. The Hanna Coal & Ore Corporation and the Hanna Nickel Smelting Co. will produce between 47,500 and 62,500 s.tons of ferro from this deposit. The ferro-nickel, it was stated, could be substituted readily for pure nickel in the production of stainless steel and various other low-alloy steels.

The Newmont Mining Corporation and the Nippon Yakin Kogyo KK (Japan Metallurgical Works) are jointly undertaking the construction of a pilot plant in Japan which will produce nickel on behalf of the American company. It is reported that with the aid of a unique technique, the pilot-plant will be able to produce nickel matte very cheaply, at approximately 400,000 yen per ton, c.i.f. Vancouver. It is also reported that the Japanese Government plans to relax its present restrictions on exports of nickel in accordance with an informal suggestion from I.M.C.

Price Trends Upward

Mr. Jess Larson, late head of D.M.P.A., has stated that the price of nickel would have to go above its present ceiling if the U.S. was to get as much of the metal as it required. Despite the general downward trend of metal prices, International Nickel found it necessary to increase the price of nickel by 3½c. lb., thus raising the price in Britain from £454 to £483 as from January 14, 1953.

Although nickel is expected to remain a critical material in the U.K., the Board of Trade and Ministry of Supply have announced some relaxations of controls on its use.

The high level of prospecting activity has resulted in significant additions to potential supplies. About 10,000,000 tons of ore containing nickel and copper are estimated to be in the Sudbury Camp area, where Falconbridge made its recent discoveries. Hudson Bay Mining & Smelting Co. made two nickel discoveries in Yukon Territory during 1952. The most important strike is 48 ft. wide and assays ±3 per cent nickel, 2.79 per cent copper, about 0.5 per cent cobalt, and about 0.1 per cent platinum.

Having regard to the severe restrictions which already exist on civilian consumption of nickel, coupled with the considerable potential peace-time uses which are awaiting development once the supply position becomes easier, the long-term prospect for this metal appears good however rearmament programmes may fluctuate.

Chromium

CHRONIUM (as chromite) is an important item in stainless steels, high temperature alloys, etc., and also has some major refractory and chemical uses. It has played an important part as a substitute for nickel in certain stainless and heat-resisting steels. The authors of the Paley Report expect the Free World consumption, which in 1950 was 1,415,000 l.tons (U.S. 875,000 l.tons) to reach 2,850,000 l.tons by 1975 (U.S. 1,750,000 l.tons). Reserves are estimated at only 2,000,000 l.tons in the U.S. and 300,000,000 l.tons in the rest of the world.

South Africa and Southern Rhodesia are respectively the chief producers of chemical and refractory grades and the Philippines are the major source of refractory-grade. Other major producers are Turkey, the U.S.S.R. and New Caledonia. In general, reserves of all three types of ore are considered ample to meet the expected 1975 Free World demand. Major obstacles are inadequate power and transportation facilities in producer countries, but with U.S. assistance output is being expanded.

Development of Important U.S. Deposits

About the middle of 1951, there was considerable concern over the chrome ore supply, the estimated shortage being 25 per cent, but the commodity was never brought into the International Materials Conference. Because of the steel strike U.S. consumption during 1952 fell to an estimated 1,192,800 s.tons compared with 1,212,480 tons for 1951. U.S. domestic production was about 20,000 s.tons (compared with 7,000 tons) while imports increased by 10 per cent to 1,580,000 tons. On April 28, 1952, D.M.P.A. signed a contract to bring into production the largest reserves of chromite in the U.S., located in Stillwater County, Mont. Production by the American Chrome Co. was expected

within a year; 900,000 s.tons of chrome concentrates of at least 38 per cent Cr_2O_3 are to be supplied by 1960.

The greater world demand for chrome has stimulated prospecting in Turkey, where the number of mining applications almost doubled in the first half of 1952. Current production of chromite is equivalent to an annual rate of 550,000 l.tons of crude ore. The majority of the Turkish chrome mines are owned by the Eti Bank working under Government supervision. Though Turkey supplied 29 per cent of the total U.S. imports in 1952, she also shipped substantial tonnages to Britain and Western Europe.

Output in Southern Africa

The Union of South Africa only sold 458,785 tons of chromite last year. Despite transportation difficulties its chrome sales increased in value to a peak of £1,683,182. But for reduced truck allocations to the chrome companies this total would have been much more.

Southern Rhodesia's output for 1952 is reported at 861,839 s.tons, an apparent increase of some 500,000 tons over 1951. Owing to railway congestion, a stockpile of more than 500,000 tons of chrome ore had accumulated.

Properties that have been unworked for years are being reopened and new chrome deposits explored. The Seymour, Selundi and Bwana M'kuba mines have been sold for about £48,000 to a London group, who plan to spend £150,000 on a development programme and hope to increase production to about 72,000 tons a year. A new quay to facilitate loading of Rhodesian chrome has been completed at the port of Beira.

The U.S.S.R. is believed to have large reserves of high grade ore, and in 1950 was credited with an output of 450,000 tons.

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Cobalt

A CONSIDERABLE improvement in the cobalt supply position took place during 1952 as a result of a substantial increase in output and larger recoveries from scrap. Free World production was computed at some 10,000 tonnes, representing an increase of 1,500 tons. The Congo produced between 6,500 and 7,000 tonnes. Of the other principal producers, French Morocco may have produced some 700 tons, Canada 650 tons and Northern Rhodesia between 400 and 500 tons. The American price of the metal (97 to 99 per cent) remained steady through the year at \$2.40 per lb. f.o.b. New York. An increase in world refinery capacity took place.

End of I.M.C. Allocation

On December 1, the Manganese-Nickel-Cobalt Committee of the International Materials Conference announced that the improved position made it unnecessary to recommend the adoption of distribution plans for cobalt for the first quarter of 1953. A week later, however, the D.P.A. disclosed that the defence programme needed more cobalt and that additional cobalt from domestic and foreign sources needed annually by the U.S. would total 13,500 s.tons.

U.S. consumption of cobalt last year made a gain of 9 per cent over 1951 at 5,393 s.tons. Imports of contained metal were up by 46 per cent at 7,584 s.tons.

Calera's refinery at Garfield, Utah, was completed in July, but production did not begin until December. Experiments at this smelter have proved the feasibility of the Chemico acid-bath process (see page 103). The planned production is 1,650 tons annually. Early in 1952, the Cobalt-Nickel Reduction Co. started construction of a separation plant at Fredericktown with a planned production of 700 tons of cobalt, 900 tons of nickel, and 700 tons

of copper. Falconbridge Nickel commenced production of electrolytic cobalt at Kristiansand in July.

During the year further progress was made in the modernization and expansion of treatment plants in the Congo, particularly those for handling the Kipushi production, and there was a further large increase in the electrolytic plant for treating the Jadotville-Shituru copper-cobalt production.

Britain secures substantial quantities of cobalt from Northern Rhodesia, supplemented by imports of Belgian Congo material and of cobalt compounds from Canada. The trend of availability in the short-term future depends largely on the new refinery at N'Kana, which started producing metal last year. It has been stated, however, that when Kilembe Mines in Uganda is in full operation, in about four years, it will produce about 2,000 to 3,500 tons of ore a day. Drilling at Kilembe continued last year at the rate of over 1,000 ft. a month.

A modern cobalt smelting and refining plant is to be established at Cobalt in Ontario under the technical direction and management of Quebec Metallurgical Industries Ltd., which is sharing in the financing of the smelter with cobalt producers and private financing companies. The company formed to operate the plant is known as Cobalt Chemicals Ltd. Facilities for refining cobalt at the plant of Deloro Smelting and Refining Co. have been raised to approximately 60 tons a month. The Silver Miller Mines of Canada announced the signing of a contract with the U.S. Government for sale of 5,000,000 tons of cobalt.

Although the Free World requirements of cobalt in 1975 have been estimated at some four-five times that of 1950, total reserves in sight should be adequate.

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Manganese

THE continued expansion of manganese production was reflected last year in an easier market position in regard to lower-grade ores. Prices were shaded down at the end of the year, Indian 48 per cent ore c.i.f. European ports being quoted at 95/100d. per unit compared with 100/105d. earlier. Long term contracts with Commonwealth producers have kept the U.K. price about 30 per cent below this level. The full benefits of higher outputs were not, however, experienced because of transport difficulties in the producing countries and the supply position should ease considerably once this bottleneck is overcome.

Among the main producers, the Gold Coast exported 794,192 tons of manganese ore, in 1952, compared with 806,000 tons in 1951, while exports from India totalled 690,000 tons of which up to 300,000 s.tons may have been of + 48 per cent manganese content; her exports in 1951 were 533,000 tons. Sales in South Africa showed a slight increase over 1951 at 717,624 s.tons. The U.S. domestic production of ore containing 35 per cent or more manganese was approximately 110,000 s.tons.

The Position in the U.S.A.

U.S. imports amounted to 2,400,000 s.tons compared with 1,768,773 tons for 1951, while in the U.K. the corresponding figures were 433,055 tons against 382,566 tons. The largest suppliers of both countries were India, the Gold Coast and the Union of South Africa. Due to steel strikes U.S. domestic consumption fell some 10 per cent to 1,650,000 s.tons.

In August, D.M.P.A. signed an agreement with the Manganese Chemicals Corporation of Minneapolis calling for the erection of a plant to treat at least 200 l.tons of

manganiferous ores per day. If this plant is successful it will pave the way for the recovery of manganese from vast low grade deposits in the Cuyula range in Minnesota.

The U.S. steel industry is developing three processes for the recovery of manganese from the slag dumps of open-hearth furnaces, all of which have proved technically feasible. The manganese contained in open-hearth slags amounts to about 772,000 tons annually.

Exports of ore from Brazil last year totalled nearly 250,000 tons with a metal content of 120,000 tons. Bethlehem Steel has signed a contract with the Companhia Industria e Comercio de Minieros for the purchase of part of the expected output of manganese from deposits at Macapá, Brazil. Production was expected to start last year and an output of 300,000 tons is anticipated for the first few years of operation. Bethlehem Steel have also obtained prospecting rights over six large areas in South-West Africa.

Increasing U.S. interest in Turkish manganese ore has been reported. A Franco-American company to undertake research and development of manganese deposits in Gabon, believed to be among the largest in the world, has been formed by the U.S. Steel Corporation and French mining interests. D.M.P.A. has signed contracts with several mining companies for the production of enough manganese ore from small Mexican mines to warrant the construction of a concentration plant at El Paso.

According to the evidence presented in the Paley Report, supplies of high-grade manganese available to the Free World over the next 25 years and beyond should be adequate to meet the normal growing demand, even without taking account of the possibility of the U.S.S.R. eventually re-entering the world market.

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Tungsten, Molybdenum and Vanadium

EARLY in 1952, the International Materials Conference reported that tungsten was likely to be scarce for the remainder of the year and for a further period. By the end of the year, however, Free World output was running at the rate of about 20,000 tonnes per annum, or nearly 40 per cent above the rate for the second half of 1951 and the I.M.C. was able to announce that it would not continue allocating tungsten because of the 50 per cent increase in Western production during the past 18 months.

Tungsten Price Declines

In January, 1952, wolfram (65 per cent) was quoted in London at 485s. (nom.) per l.ton c.i.f. U.K. At the end of June the Ministry of Materials lowered its selling price from 500s. to 476s. 6d. per l.ton unit and its buying price to 425s. At the end of the year the Ministry was able to lower its buying price to 370s. per unit for wolfram and 360s. for scheelite, and U.K. importers were showing more disposition to pick and choose. To facilitate administrative arrangements for the Government control of purchase, and distribution of wolfram ores, a new company known as British Tungsten Ltd. was formed by three metal firms during 1952 to act as the official buying agency of the Ministry of Materials.

In the United States, N.P.A. dropped allocations of pure tungsten and ferro-tungsten, while the D.M.P.A. was considering the removal of allocations on tungsten ores.

The programme announced in 1951, which provides for the purchase by the U.S. Government of standard-grade tungsten concentrates at \$63 per s.ton unit until July 1, 1956, or until 3,000,000 units have been produced, has done much to stimulate domestic production. Last year the allowable

molybdenum content in tungsten concentrates was raised from 0.40 per cent to 2.75 per cent and this was of great assistance to many producers. As a result of these measures domestic production of tungsten in the U.S. rose to approximately 7,168 s.tons of 60 per cent WO_3 , compared with 6,214 tons produced in 1951, while imports rose to 18,310 tons as against 6,700 tons. On the other hand, consumption fell in the same period from 11,989 to 9,073 tons. Most of this surplus presumably went into the stockpile.

Whatever may be the short term prospect for tungsten once stockpiling ceases, the long term future—at any rate as foreseen in the Paley Report—is promising, it being estimated in the report that Free World consumption will increase about $2\frac{1}{2}$ times in the next 25 years.

During the year D.M.P.A. established a new expansion goal for tungsten, namely a total supply of 17,000 s.tons of contained tungsten from both domestic and foreign sources by 1954. This is equivalent to approximately 30,000 s.tons of 60 per cent WO_3 . By the end of last year U.S. Government purchases of domestic metal had reached 840 s.tons.

Almost one-half of South Korea's total exports, according to value, consist of tungsten, and the U.S. is enjoying a monopoly of these deliveries. During the last fiscal year South Korea exported tungsten valued at \$9,500,000, all of which went towards the U.S. stockpile. Exports to the U.S. are steadily increasing and new mining equipment is expected to enlarge the output further. U.S. army engineers are supervising the working of tungsten mines.

Portuguese ore shipments totalled 4,495 tonnes against 4,223 in 1951, but exports to Britain fell from 2,288 to 1,654 tons, the U.S. becoming the leading market. The

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Portuguese Minister of Economy has declared that the present export tax on wolfram ores is to be maintained, despite the sharp decline in world prices. The trade in Portugal is discussed by our correspondent on page 161.

The U.S. Export-Import Bank has approved a loan of \$1,000,000 to the Bolivian Tin & Tungsten Mines Corp. to help expand the production of tungsten from the Kami Araca mines. The corporation is to sell its tungsten output to the U.S. between 1952 and 1957.

Production at the Emerald Mine in British Columbia, which is the first tungsten producer in Canada to be reopened since World War II, has now been increased from 250 tons of ore to between 600 and 700 a day. Australia is also increasing production, while in Uganda the Government and the recently formed Mining Association have arranged with the Ministry of Materials to buy all wolfram produced in the Colony over the next five years at current market prices, subject to a guaranteed floor price of 250s. per 1.0 ton unit delivered London.

Molybdenum

Molybdenum is still on the U.S. critical materials list with vanadium among the strategic materials for which the stockpiling objective has not yet been achieved, notwithstanding the fact that the States is the only major producer of both metals. Since July 1, 1951, when molybdenum was put under international allocation, production of this metal has been considerably increased. The Tungsten-Molybdenum Committee of the I.M.C. estimated the Free World production of molybdenum during the first six months of 1952 at 10,016 tonnes, representing a gain of about 20 per cent in 12 months. The Committee announced a distribution plan for the first quarter of 1953, which was accepted by the thirteen countries represented. The U.S. quota was 4,999 tonnes, metal content, of which 186 tons

were for export as primary products, and the U.K. was allocated 540 tons. World production for the quarter was estimated at 6,408 tonnes, representing an increase of more than 75 per cent over the rate in 1950. In its year-end report the I.M.C. stated that molybdenum continued to be in very short supply, defence and stockpiling requirements being still much in excess of the estimated production, and it urged that every attention should be given to its recommendations for conservation and substitution.

At 21,633 s.tons (contained molybdenum) for 1952, compared with 19,428 s.tons in 1951, U.S. production accounted for about 87 per cent of the total Free World output. The only other nation producing a significant quantity of molybdenum was Chile.

Vanadium

The U.S. is also the largest producer and consumer of vanadium, normally accounting for over half the Free World production. The bulk of this production comes from the Colorado-Utah region, where it is recovered as a by-product along with uranium. The only other producers of any significance are Peru, where the deposits are owned by the Vanadium Corporation and Northern Rhodesia and South-West Africa.

Information is not readily available regarding the production and reserves of vanadium owing to the common association of the ores with those of uranium. Vanadium has, however, also been recovered commercially from a wide variety of sources including bauxite, iron and chrome ores as well as soot from ships burning Venezuelan and Mexican oil.

Although demand is still ahead of supply, vanadium is probably one of the less critical of the ferro-alloy elements, its present high price acting as a heavy brake on any extension of its use.

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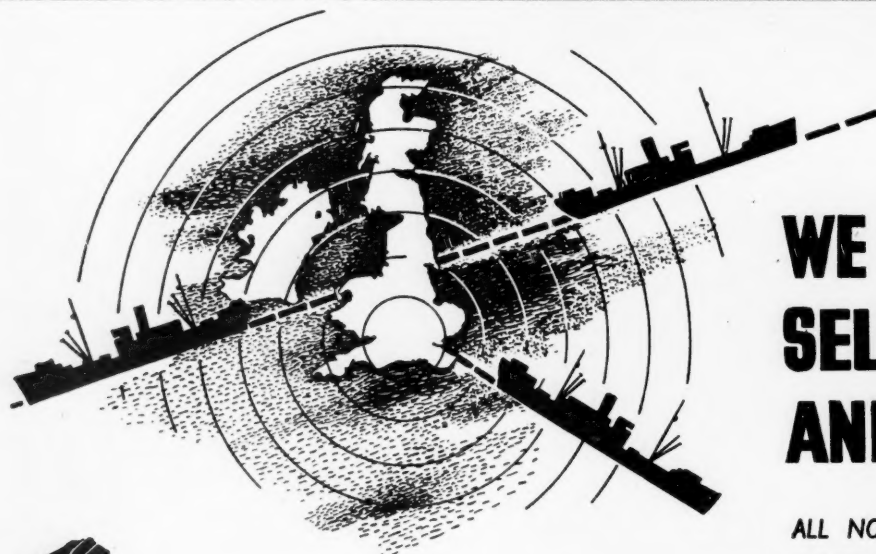
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Beryllium

THE year 1952 brought a marked increase in the quantity of beryl ore available for use in beryllium alloys and products. World production rose to an estimated total of 7,000 s.tons in 1952, compared with 5,590 tons the previous year.

United States

U.S. domestic production was expanded from an estimated 404 s.tons in 1951 to 550 tons last year and imports into the States rose from 4,316 to 5,500 tons, averaging plus 10 per cent BeO, of which perhaps 40 per cent came from Brazil, the world's principal producer.

In October, the General Services Administration instituted a purchasing programme for domestically produced beryl ore containing not less than 8 per cent BeO by weight. Three purchasing depots have been set up and the Administration is paying a flat price of 20c. per lb. or \$400 a ton with payment increasing for higher grades of ore. The programme runs until June 30, 1955, or until 1,500 tons of beryl have been delivered to the depot.

In May last year, Beryllium Development, Inc. announced that it had started operations in connection with the exploration, development and mining of pegmatites in the Newry Mountain district, near Andover, Maine. This company is a wholly owned subsidiary of the Beryllium Corporation of Reading, Pa. The work is being done with U.S. Government assistance and is part of a broad programme undertaken by Beryllium Development, Inc. on a nation-wide basis.

Brazil

The Brazilian Government agreed to allow 4,000 tonnes of beryllium ore to be exported last year, at a minimum price of 919 cruzieros (£18 7s. 7d.) per unit of contained

metal, 90 per cent of the value to be paid against shipping documents. In 1951, exports were restricted to 1,500 tonnes in order to accumulate stocks in Brazil.

A Brazilian company, Proberil S.A., associated with American capital, has been formed to manufacture beryllium oxides at Rezende, S. Paulo. It has acquired one of the most important beryllium mines in Minas Geraes and will have an initial output of 80 tonnes annually.

Southern Africa

Production in Southern Rhodesia again showed an increase at 1,186 tons of ore. Figures for South Africa and South-West Africa were respectively 413 and 591 tons compared with 583 and 741 tons in 1951.

An expansion goal to provide facilities for the production of 1,000,000 lb. monthly of 3½ per cent to 4 per cent beryllium copper master alloy by January 1, 1955, has been announced by the U.S. Defence Production Administration. The expansion will increase capacity by 700,000 lb. monthly over the January 1, 1952 capacity of 300,000 lb. monthly. At the same time, D.P.A. set a goal for added fabricating facilities to convert 755,000 lb. per month of beryllium copper master alloy into mill shapes and forms, also to be completed by January 1, 1955.

The Paley Report places commercial reserves of recoverable beryl in the U.S. at about 15,000 tons and in the rest of the Free World at about 175,000 tons. With increased exploration and development and with improved methods of beneficiation, it is expected that this total will be substantially increased during the next 25 years. The view is held that, even if merely maintained, these reserves will be sufficient to meet projected free world requirements, which are expected to rise from 4,145 s.tons in 1950 to about 11,000 tons in 1975.

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Columbium and Tantalum

THE authors of the Paley Report consider that the outlook for large increases in columbium supplies is not favourable and that there is little probability of sufficient quantities being forthcoming to satisfy the potential demand for high-temperature alloys. The view was expressed that maintenance of the Nigerian output, which comprises some 95 per cent of the world production, might require a rise in the price of columbium in order to allow lower grade material to be worked.

This condition was fulfilled in May, 1952, when D.M.P.A. announced the establishment of a government-guaranteed purchase programme to stimulate the search for and development of columbium and tantalum deposits both in the U.S. and abroad. A bonus amounting to 100 per cent of the base price (which is on a sliding scale according to grade) is payable by the U.S. Government to the actual producer of the ore, the offer holding good till December 31, 1956, or until the government has acquired 15,000,000 lb. This programme was later extended to include small lot shipments from smaller domestic producers.

Since the introduction of this bonus scheme, important developments have taken place. The Gold Coast Selection Trust has disposed of certain areas and options in the Lirue-Ng'Kano district to Gold and Base Metal Mines of Nigeria Ltd., who have also taken over certain areas in the same district from United Tin Areas of Nigeria Ltd. As a result, it is expected that production of columbite by Gold and Base Metal Mines will rise to over 80 tons in 1953 and to over 150 tons in 1955-56. In 1952 the output was 26 tons. United Tin Areas received £2,500 per ton for its columbite during the last six months of 1952. Of the

major Nigerian producers, Amalgamated Tin Mines output during 1952 was 478 tons while Jantar produced 222 tons, and Bisichi 155 tons. The known reserves of alluvial columbium in Nigeria were reported to be 7,166 tons of proved and 2,624 tons of estimated ore at March 31, 1951.

Deposits of pyrochlore have been under investigation in East and Central Africa. It is hoped that exploitation of a soil belt containing this mineral will be one of the new industrial projects to utilize power from the Owen-Falls hydro-electric scheme. The search for columbium minerals was extended to Nyasaland in 1951 and led to the discovery of deposits of pyrochlore of relatively low radioactivity.

Work has started on the development of columbium ore deposits in Telemark, Northern Norway, where a crushing plant is to be built. In Australia a reportedly large deposit of a combined columbite tantalite ore within 50 miles of Darwin will be mined shortly. Trial shipments of columbite were made during 1952 from the Mazaruni River district of British Guiana, where some 2,000,000 lb. are tentatively estimated to be present in eluvial deposits. The principal problems are beneficiation and determining the most economical way of working the deposits.

Another development which may well prove of very considerable importance is the research work done last year by the U.S. Geological Survey into the possibility of recovering columbium from wastes arising from the processing of Arkansas bauxites. The columbium content of these ores is about 0.05 per cent and if metallurgical methods of recovering this, from the red and brown mud wastes can be developed, the potential output could be as much as 80 per cent of the present U.S. imports.

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Iron and Steel

By Our Own Correspondent

THE atmosphere in the steel industry is changing. For the first time for many years, the attentive ear can catch a whisper of the word redundancy. There are indications that the shortage of steel which has persisted throughout the post-war years, is at last being overtaken, and there is a note of confidence in recent forecasts that before the end of the current year supplies of steel will be freely available.

Tremendous Expansion in Output

The expansion of world steel production during the past five years has been phenomenal. From 134,000,000 tons in 1947, output has risen to 208,000,000 tons in 1952 and this despite the 58-day strike in U.S.A. which is said to have involved a production loss of some 16,000,000 tons.

But for this stoppage American steel production last year must have verged closely upon the round figure of 100,000,000 tons and the world total raised to about 225,000,000 tons.

Approximately 45 per cent of the world's steel capacity is concentrated in the United States alone. Completion of development plans already in hand will raise U.S. capacity to about 110,000,000 tons by the end of this year, and thereafter the major producers seem disposed to call a halt; or at least to take a pause for re-examination of the relationship between supply and potential demand.

The technical efficiency of American steel plants is beyond dispute. But production costs are high, and the price factor discourages hopes of any considerable expansion of U.S. steel exports in a free market.

So far as Europe is concerned the most arresting feature of the production statistics is the rapid advance of the Soviet bloc. According to the Economic Commission for Europe, Russian output last year increased by 12 per cent to the record figure of 34,447,000 tons and in the five Russian satellites—Czechoslovakia, Poland, Eastern Germany, Hungary and Rumania—the steel step up amounted to 14 per cent. In comparison, British ingot production was only about 750,000 tons better than in 1951, and for the first time the U.K. steel imports exceeded the export tonnage.

Activity in Western Europe

Western Europe is, however, moving into action. Since the turn of the year British steel production has been running at record levels, and with the first development plan virtually complete, a second plan has been approved with the avowed purpose of raising steel capacity to 20,000,000 tons per annum. Western German steel interests have set themselves a similar target and the other member States of the Schumann pool have prepared development plans on a no less ambitious scale. Not all those grandiose projects are likely to come to fruition. All are subject to the approval (or the veto) of the High Authority which has many problems to solve in reconciling the conflicting ambitions of its constituents.

From the deliberations of the High Authority, British

interests have not remained completely aloof. Without complete surrender to the ardent wooing of M. Monnet, the British Government has appointed a special delegation led by Sir Cecil Weir, which is at present exploring, through the medium of a joint committee, the possibilities of co-operation as an alternative to such encroachment upon sovereign rights as would be necessary if Britain were to become a full member of the community. Short of this, there is of course ample scope for concerted action between Great Britain and the European Coal and Steel Community which M. Monnet desires to be "as comprehensive as possible," and Sir Cecil Weir is no less appreciative of the opportunities now presented by this new attempt of hitherto warring nations to merge the most essential element in their economies.

Throughout Western Germany, France, Belgium, Luxembourg, Holland and Italy, a single market has been established for coal, iron ore, scrap and steel, the main barriers to free trade between the six nations have been broken down and the supranational authority is now engaged in the elimination of discriminatory prices, quotas, import and export duties and all quantitative restrictions on the movement of coal and steel within the Community Area. From a levy on these products the High Authority expects an annual revenue of some £20,000,000 a large part of which is to be used in the expansion and modernization of the industries concerned.

In this respect the British steel industry enjoys all the advantages of a flying start. Completion of the first development plan has raised technical efficiency to a high level, enabled the industry to attain record outputs of pig iron as well as steel, and has so far reduced production costs as to maintain prices at well below world levels.

Momentous Changes Impending

Nevertheless, momentous changes in the political and economic structure of the British steel industry are impending. The end of the brief experiment in nationalized steel is at hand. Very shortly, the Steel Bill which restores the principle of State control without ownership will reach the Statute Book and iron and steel plants will be up for sale to the highest bidder.

Disposal of the assets at an equitable figure may present many problems. The private investor will not be unmindful of the fact that the industry as a whole is committed to a second development plan which will necessitate the provision of new capital at the rate of about £60,000,000 per annum over the next four years.

The first five year plan was largely financed by the industry's liquid resources; for the completion of the second plan the industry will probably have to rely upon publicly subscribed funds.

Between the Government and the steel masters there is no dispute concerning the policy of the further projects for expansion of capacity and the substitution of new plant for old. Will there be an assured market for the

WORLD STEEL PRODUCTION

(millions L.tons)

	1937	1951	1952*
U.S.A.	50.57	93.93	83.18
U.S.S.R.	17.54	30.80	34.45
U.K.	12.98	15.64	16.42
Western Germany...	15.37	13.29	15.56
France	7.79	9.68	10.70
Eastern Europe....	6.45	9.39	10.66
Belgium	3.80	4.99	5.02
Luxembourg	2.47	3.03	2.95
Italy	2.05	3.01	3.48
Saar	2.30	2.56	2.78
Other Western			
European Countries	3.09	5.02	5.43
Canada	1.40	3.19	3.32
India	1.26	1.50	1.60
Australia	1.10	1.44	1.50
South Africa	0.33	0.93	1.20
South America	0.77	1.71	2.00
Other countries....	1.01	7.27	7.90
TOTAL	130.28	207.33	208.57

*Partly estimated.

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20,000,000 tons of British steel which is the new target fixed by the Federation?

Apart from the expansion of capacity in the U.S., in the Soviet bloc, and in Western Europe to which allusion has already been made, appreciably larger outputs are planned by the four Commonwealth producers—Canada, South Africa, Australia and India. In Latin America, which has immense ore resources but lacks suitable coal and transport, infant enterprises are developing. Spanish interests have recently placed definite contracts for the construction of a new integrated steel plant at Aviles in Northern Spain.

These new enterprises may not all be strictly justifiable from an economic point of view, but their fulfilment must necessarily restrict the volume of overseas trade in steel. The ultimate test of survival will no doubt be technical efficiency and the low cost of production. From both these tests the British steel industry creditably emerges. Resistance to inflationary influences, substantial fuel economies and the progressive application of scientific methods are amongst the outstanding post-war achievements of British industry. There has also been a notable shift from the export of steel in its cruder forms to that of more highly valued end products in the form of ships, machinery, locomotives and producer plants. Many engineering firms, and ship builders, are even to-day in the happy position of having full or nearly full order books for the next five years and their principal anxiety is that they may be assured of ample deliveries of steel of the right type at the right time.

Problems of the British Industry

The further rise in coal prices which became operative at the beginning of March is a matter of grave concern to every branch of British industry. Upon British transport, gas and electricity and by no means least upon British steel, high cost coal constitutes an oppressive burden and the British Iron & Steel Corporation has been able to support with convincing data its application for the translation of higher fuel costs into terms of increases in the maximum controlled prices of iron and steel, which with minor exceptions had remained unchanged since February, 1952.

The most serious problem which in greater or less degree confronts the steel industry of every nation is the production, transport and assembly of the prodigious tonnages of raw materials which are required to keep the plants in regular operation. It has been calculated that about 55,000,000 tons of iron ore scrap, limestone and coal were consumed last year to produce 16,400,000 tons of steel, and to reach the new target of 20,000,000 ingot tons the supply of raw materials would need to be increased by another 12,500,000 tons.

Physical as well as commercial problems are involved. The availability of sea and rail transport is a question which cannot be ignored, and still less the growing competition for steel making materials which ensues upon the expansion of steel making capacity.

There is, no doubt, a plenitude of iron ore in areas undeveloped or still in the early stages of development. Ultimately, the exploitation of new ore fields in Quebec, Labrador, Venezuela and Liberia will, it is hoped, lead to the cessation of American demands upon the exportable supplies from North Africa. Similarly, the establishment of the European Coal-Steel Community will probably lead to a more intensive use of the minette ores from Lorraine. But the immediate pressure on Europe's conventional sources of high grade ores is intense, and although Sweden is planning to increase her exports of iron ore from 16,500,000 to 20,000,000 tons, British interests are actively associated in the opening of entirely new sources of supply.

From Wabana in Newfoundland it is hoped to increase shipments to a maximum of about 1,000,000 tons, and new deposits in Sierra Leone and Conakry (French West Africa) have now reached the initial stage of production. A decision is also expected shortly regarding British participation in a costly project to develop the known large deposits of rich ores in the interior of Mauretania.

These may ultimately provide a more balanced flow of foreign ores for the British steel industry. But in the meantime it may be observed that whereas approximately 9,500,000 tons of ores were imported by the U.K. last year the total consumption of home ores was in the region of 16,000,000 tons.

Coking Capacity

The chief limiting factor in the more extensive use of home ores is the higher coke consumption involved in the smelting of the lean native ironstone. For several years past coking capacity and also the output of first class coking coal has been barely adequate. At present the industry uses about 12,000,000 tons of coke per annum which calls for about 20,000,000 tons of coking coal. Much more will be needed to reach the target of an ultimate output of 15,000,000 tons of pig iron. Steady progress is being made with the provision of additional coking capacity but of the supply of the increased tonnages of coal the best that can be said is that the industry is in close consultation with the Ministry and continues to depend upon the provision of about 4,000,000 tons of furnace coke by the N.C.B.

Possibly the last rise in coal prices may give some further impetus to the conversion of some of the steel plants to oil firing. In the same way the dearth of ore transport two years ago and the consequent inflation of freights compelled the industry, in partnership with certain other interests, to place orders for the building of 15 specialized carriers which will shortly be available for the regular transport of foreign ores. Modern equipment for the expeditious handling of ore cargoes at some of the principal ports has immensely speeded up the turn round of the ships at the terminal points, and similar results have attended the introduction of ore wagons of special design on the railways.

Expansion of Pig Iron Production

The conclusion is that the industry can rely upon a progressive expansion of pig iron production as more new blast furnaces of greater capacity than any at present in operation, become available. This has become all the more essential since the percentage of scrap available for use in the melting shops has steadily declined.

No doubt the shrinkage of U.K. imports of scrap from about 2,000,000 tons in 1950 to less than 600,000 tons in 1951 was not wholly unforeseen. The supply of battlefield scrap was approaching exhaustion and German interests with an eye to the increasing needs of an expanding steel industry were reluctant to part with their scrap to the U.K. or the U.S.

By intensive effort; the collections of home scrap were raised last year by about 470,000 tons. The steel makers themselves made a large contribution by throwing up 268,000 tons of scrap over and above their normal arisings and the ultimate result was that an aggregate of 9.3 tonnes of scrap were made available for the U.K. steel industry in 1952. This has enabled the steel makers to build up their depleted stocks to some small extent, but the need for increased supplies is still urgent and in the programme for the current year the continuance and indeed the intensification of the home scrap drive, occupies a prominent place.

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The Coal Industry

By W. DAVIES, B.Sc., Ph.D.

THE most important event connected with the coal industry in Western Europe during 1952 was the formal constitution of the High Authority of the Coal and Steel Pool at Strasbourg on August 10. This Authority now controls the production and distribution of coal and steel for a population of 140,000,000 people spread over an area of about 500,000 sq. miles comprising West Germany, France, Belgium, the Netherlands, Italy and Luxembourg, and it forms a new economic unit which now ranks third after the United States and the Soviet Union in the production of coal. The High Authority's claim to be on a par with sovereign states in international affairs has already been recognized by Great Britain, the United States, Sweden and Norway, whose Governments maintain contact with it.

A Common Market

During the second half of the year steps were being taken to create a common market for coal and scrap iron within the Pool area by eliminating export duties and differential transport tariffs and by fixing a standard pithead price for coal on which a tax is to be levied to provide a fund for financing capital investments in the industry and to cover the costs of administration. The output of hard coal in the Pool area in 1952 was 240,000,000 tonnes, of which 4,500,000 tonnes was exported to other parts of Europe, together with about 5,000,000 tonnes of coke, mainly from West Germany to Sweden. Imports into the area during the year amounted to 22,300,000 tonnes, mainly from the U.S.A. and Great Britain.

The High Authority has been given wide powers to co-ordinate investments in the coal and steel industries of the member countries and plans have been made to increase the production of hard coal to 280,000,000 tonnes per annum within a period of five years. Current investments are being devoted to raising the production of coking coals, the modernization and extension of power generating stations in the coalfields and to the expansion of the lignite briquetting industry. A considerable proportion of the available funds will also be used during the next five years to build new houses for miners and steelworkers.

Coal-face mechanization is making slower progress on the Continent than in the United States and Great Britain. The highest stage of development in this respect within the Pool area has been reached in West Germany where, towards the end of the year, there were about 70 coal cutters and about 50 coal ploughs in use. It was estimated that about 100,000 tonnes of hard coal a day was obtained during 1952 in the Ruhr on partially or completely mechanized faces, but the bulk of the coal in Western Europe is being mined by hand with the aid of pneumatic picks.

Great Britain

The first table shows that Great Britain now occupies fourth place in order of total coal production, but if the list were to be arranged in the order of coal output per head of population, or per sq. mile of territory, it would easily hold first place. In view of this, and for various other reasons, the refusal of the British Government to join the European Coal and Steel Community was not un-

expected and recent events tend to confirm the wisdom of this decision, for the inclusion of Great Britain in the Pool at this stage would have added to the difficulties which are being experienced in making the initial international adjustments required to make the Pool work.

The output of deep-mined coal in Great Britain in 1952 was 2,480,000 tons higher than in 1951, but this increase was not commensurate with the rise in manpower. The figures given in the second table show that the output per manshift was lower than in the previous year, both at the face and overall. This came as a disappointment because the downward trend in productivity during the earlier part of the year should have been more than counterbalanced before the end of the year when more trained men became available to work on newly opened faces. It seems that

this is now beginning to have a belated effect. The most satisfactory feature of the recruitment of labour during the year was an increase of 25 per cent over 1951 in the number of juveniles under the age of 18 coming into the industry. About 10,000 fewer men were lost to the industry through normal wastage and the number in the 21-30 age-group who left the mines in 1952 was 30 per cent lower than in 1951.

The financial position of the National Coal Board deteriorated very considerably during the third and fourth quarters on account of the rise in the cost of materials and labour. The Chairman of the Board stated recently that the accumulated loss is now approaching £14,000,000.

The pit-head price of coal was raised by 5s. a ton at the beginning of the year and the Board found it necessary to increase the price again recently by 10 per cent to enable them to meet their financial obligations during the current year. This last increase does not affect export prices but home consumers now pay about 10s. 6d. a ton more for coal than they did at the end of 1951.

The Wages Problem

The rejection of the miners' demand for a general wage increase of 30s. a week led to a certain amount of unrest in the coalfields during the second half of the year but a major clash on this issue was averted and eventually the lower paid workers were granted an increase of 6s. a week, pending a general overhaul of the wage structure throughout the industry. The amount of coal lost through disputes of various kinds during the year was 1,390,000 tons and this was the second highest loss sustained in this way since the mines were nationalized.

The expenditure on capital investments in 1952 was £36,000,000 against the Plan for Coal estimate of £58,900,000. These figures have been corrected for changing values since 1949 and the difference between them gives a true indication of the lag in the development programme in 1952. The amount actually spent covered the cost of new equipment for existing mines and only about a third of the total sum was spent on new projects costing more than £500,000 individually. In view of the criticism which is sometimes made that the industry is being hampered by over-centralization, it should be stated that the Divisional Boards are allowed considerable latitude in the matter of capital expenditure. They are required to submit plans to the National Board for approval only when their projected

PRINCIPAL PRODUCING COUNTRIES

(in millions of tons)*

	1950	1951	1952†
U.S.A.	497	576	505
U.S.S.R.	252	290	300
European Community	291	313	360
Great Britain	215	223	227
Poland	81	87	92
Czechoslovakia	45	N.A.	N.A.
Japan	39	43	42
India	32	32	36
South Africa	26	26	28
Australia	24	24	25
Canada	17	17	17
New Zealand	3	3	3
Southern Rhodesia ...	2	2	3

*The tonnage is given in long, metric or short tons according to the general usage in each country.

†Provisional.

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schemes are likely to cost more than £300,000 individually.

Mechanization

About 80 per cent of the output from deep mines in 1952 was undercut by machines and nearly 90 per cent of it was mechanically conveyed from the faces but the amount mechanically loaded at the face was only about 3 per cent. Power loading is therefore still ineffective as a general aid to coal mining in Great Britain and this is by far the greatest obstacle to the realization of the full benefits of mechanization. The progress made in the limited field of undercutting and conveying may be judged from the fact that the power used at the coal face increased from 1.34 h.p. per face worker in 1943 to 2.05 h.p. in 1952. The output per manshift at the face during the same period increased from 2.75 tons to 3.15 tons, so that during the last decade an increase of 53 per cent in power consumption at the face has been accompanied by an increase of only 14 per cent in productivity. It is unlikely that a radical change in this trend will take place until a much larger proportion of the total output can be loaded by machines on long-wall faces.

Progress in the East Midlands Division

It is in the East Midlands Division that the problem is being studied most closely and it is significant that the output per manshift at the face in this Division in 1952 was 4.65 tons compared with the national average of 3.15 tons, but even here only 12 per cent of output was loaded mechanically during the year so that a substantial improvement is to be looked for with each real advance in mechanical loading. Most of the mechanical loading done at present is carried out by Meco-Moore machines, of which there are about 60 in use in the East Midlands Division and about 110 throughout the country. Other machines in use and on trial during the year included Huwood loaders, Samson strippers, coal ploughs, Gloster getters, trepanners, continuous miners, multi-disc machines as well as ordinary coal cutters fitted with flights for loading.

The first and last of these machines are designed for loading only whilst the others cut and load simultaneously. All these machines are naturally being tried out first where the working conditions appear to be most favourable therefore it is unlikely that the very high outputs which some of them are now giving in initial trials will be maintained when they come into more general use under less favourable mining conditions.

Experimental Machinery on Test

Practically all the available types of machines and equipment for tunnelling were in use or on trial during the year, particularly in connection with the development of the new horizon systems. Some progress was made in the further development of pneumatic and other types of stowing and packing machines. The study of different methods of draining and collecting methane underground continued and some experiments were carried out, in conjunction with the British Hydromechanics Research Association, on the hydraulic transportation of coal through pipes.

U.S.A.

It was estimated at the beginning of the year that the demand for bituminous coal in 1952 would amount to 565,000,000 tons but it fell short of this by as much as 100,000,000 tons. This big drop in demand was due in the main to the protracted strike in the steel industry but there was also a marked decrease in the demand for domestic coal, on account of the growing use of oil as well as natural gas.

The productive capacity of the coal industry is now considerably in excess of requirements, but in spite of this, individual mining companies are striving to increase their productivity by mechanization in order to cut production costs to meet the competition of oil, natural gas and hydro-electric power. The Vice-President of the Lehigh Navigational Coal Co. has suggested that the amalgamation of all the mines in the anthracite area under a single company would be the best way of dealing with the present crisis. He has given it as his estimate that this would effect an annual saving of \$75,000,000 on operating costs and would enable the selling price of anthracite to be reduced by \$5 a ton.

The output of anthracite last year amounted to about 8 per cent of the total coal produced and 26 per cent of it came from open-cast mines, which also supplied 23 per cent of the bituminous coal. The whole of the open-cast output and 60 per cent of that obtained underground was loaded by machines and the average output per manshift was 7.25 tons in bituminous mines and 2.95 tons in the anthracite mines.

Continuous Mining

Much attention was given during the year to the possibilities of continuous mining and it is estimated that about 200 machines of the continuous miner type were in use in different parts of the country towards the end of the year. The types which are now being built use one or other of the following arrangements:

- (1) Cutter picks mounted on chains, bars, discs or drums which rip the coal off the face on to a loading device or a conveyor.
- (2) Boring tools working in conjunction with wedges which are driven into the cuts made by the borers to burst the coal from the face.
- (3) Reciprocating hammers working in conjunction with undercutting and shearing jibs.
- (4) Inter-meshing augers on the front end of a telescopic conveyor which is extended as the augers advance into the seam. The large machines used in open-cast mines are capable of penetrating to a distance of 700 ft. into the seam from the exposed face whilst being controlled from the outside. Cuts up to 10 ft. wide and 4 ft. high can be taken and some machines are capable of producing over 1,000 tons of coal a day in two shifts.

Machines of this class cannot produce large coal but their development at the present time is not incompatible with current trends in coal utilization because of the rapid advance which is being made in use of mechanical stokers resulting in a consequent reduction in the demand for large coal.

OUTPUT AND MANPOWER IN GREAT BRITAIN

	1951	1952
Deep-mined coal (millions of tons)	211.87	214.35
Open-cast coal (millions of tons)	11.02	12.16
Total (millions of tons) ...	222.89	226.51
O.M.S. at face (tons)	3.17	3.15
O.M.S. overall (tons)	1.21	1.19
Output per man-year (tons)	303	300
Average number of workers at face	287,000	293,000
Average number of workers altogether ...	699,000	715,000

The Oil Industry

By W. J. HARRIS

ONE of the most characteristic features distinguishing the international oil industry is the unflinching regularity with which it breaks former production records. Last year was no exception to this rule—and, as shown in the accompanying statistical table, world oil production considerably exceeded that for the previous year—itself a record when accomplished. At the same time, 1952 saw exploration and expansion of all necessary production and ancillary facilities continued unabated.

The United States

America was the world's largest single oil producer. A glance at the supporting table will show that U.S. petroleum output in 1952 again approximated to half of the oil production of the entire world. For this reason it is especially encouraging to be able to report that, notwithstanding a record year's output both by America and for the world as a whole, the world's proven oil reserves—including those of the U.S.A. herself—stood at a record high level as at December 31 last. During 1952, also, U.S. oil companies are estimated to have spent the record sum of very nearly 4,000,000 dollars in expanding and developing their activities in all spheres. That an even greater sum is expected to be spent this year by U.S. companies in like manner, and that this sum excludes the vast amounts being similarly expended by British, Dutch and other oil interests, is a good indication of the tremendous capital requirements of the international oil industry in its global operations.

Venezuela

Venezuela—second largest oil-producing country—also enjoyed a record year's output. It was, in fact, her contribution which chiefly accounted for the increase in output from the Caribbean area. At one time, indeed, Venezuela's rate of output was equivalent to an annual yield of over 100,000,000 tonnes. A subsequent slight slow-down was caused not through any difficulty over production but solely through economic developments in consuming areas outside Venezuela putting a temporary brake upon her output.

The Middle East

The Middle East returned most encouraging production figures in the year just past—as was to be expected. Persia excluded, all the major oil-producing countries of this area substantially improved upon their previous year's outputs, and the Middle East as a whole—despite Persia's virtual shut-down—became the world's largest oil-producing area after North America. A reference to the production table shows that Saudi Arabia remained the largest single Middle Eastern producing country, but the biggest proportionate increase came from Iraq—who more than doubled her 1951 output.

The reason for Iraq's spectacular leap forward was the opening, in the spring, of the new pipeline linking her prolific Kirkuk oil field with a Mediterranean tanker terminal at Banias (Syria). This line has an annual capacity of 14,000,000 tons. At the end of 1952, Iraq's total production was running at a rate of over 25,000,000 tons a year.

So far as Saudi Arabia is concerned, one noticeable factor in her 1952 oil development programme was the expansion of activities in the large new oilfields of Ain Dar and Ithmaniya. These fields are accounting for an increasing proportion of Saudi Arabian output, although this still comes principally from the country's outstanding oilfield of Abqaiq.

No review of the past year can omit a reference to the splendid work that has been continued in the Burgan oilfield of Kuwait—the only field that country as yet possesses. This one field—brought into production as recently as 1946—yielded last year close on 40,000,000 tonnes, and it may be thought that to have thus developed production from scratch in so comparatively short a time is a striking tribute to the British and American interests who are jointly concerned in this undertaking. Last year's heavy rate of production in Kuwait also demonstrated the wisdom shown a year or two earlier in the building of the magnificent new Kuwait deep-water tanker terminal known as Menaal-Ahmadi. This depot, reckoned to be one of the most up-to-date of its kind in the world, can accommodate the large "super" class of tanker with ease, and prevented the development of any bottleneck in tanker loading.

The Far East

In the Far East, one of the encouraging events of the year was the initiation of production from the central Sumatran field of Minas. This achievement was one reason for Far Eastern output as a whole showing nearly a million tonnes improvement over 1951 figures.

Development generally here has been steady rather than spectacular, although no effort is being spared in seeking new oil deposits as well as in expanding oilfields already located. Just before last Christmas, for example, a start was made on the drilling of the first four wells which are to be sunk under the sea off the coast of British Borneo, the purpose being to locate the underwater extension of the adjacent inland oilfield of Seria. Deep test drilling was also continued in Papua, where at the turn of the year plans were made for an aerial survey to cover an area of over 35,000 sq. miles. This survey is now in fact under way. Another project announced at the year end was a new geophysical survey of regions in East Africa, and this too has since been put in hand.

Canada

One country that was constantly in the news where oil production is concerned was Canada. Last year saw exploration maintained at a high pitch of activity, which was, indeed, intensified as the year wore on. At the close of 1952, it was estimated that no fewer than 175 geophysical exploration parties were out on field assignments and several hundred million dollars were spent solely on the search for new oil deposits. Production increased appreciably as shown in the supporting table—not only as a result of numerous new discoveries but also as a result of improved transport facilities making their effect transparent. It may be worth while recording here that,

WORLD PETROLEUM PRODUCTION
including natural gasoline.
(Metric tons).

	1951	1952.†
U.S.A.	324,200,000	332,600,000
Venezuela	90,900,000	95,000,000
U.S.S.R.		
(inc. Sakhalin)	42,000,000	47,500,000
Saudi Arabia ...	37,100,000	40,400,000
Kuwait	28,200,000	37,600,000
Iraq	8,700,000	18,700,000
Persia	16,400,000*	Negligible
Mexico	11,000,000	11,000,000
Indonesia	7,600,000	8,500,000
Canada	6,400,000	8,500,000
Colombia	5,600,000	5,500,000
British Borneo ..	5,000,000	5,000,000
Others	26,900,000	30,700,000
TOTAL	610,000,000	641,000,000

† Figures for 1952 are provisional.

* Persian output for 1951 was for the period Jan./July only, after which oil operations were suspended.

according to plans announced at the close of 1952, this year should see even greater activity in all phases of Canada's oil industry.

Refinery Developments

Coming closer home, Britain herself was the scene of notable progress in the refining field. By the beginning of November, the Government was enabled to announce the restoration, as from February 1 this year, of premier-grade petrol—due entirely to the construction in this country of the necessary catalytic cracking units essential in the production of this type of fuel. Six of these units have been built in this country—four of which were completed well in time for service on February 1, while two are expected to come into operation in the near future. At the same time, work has been steadily continued in the development of our refining capacity generally, and 1952 saw its very fair share of important new units brought into operation at our major refineries.

This refinery expansion programme—which has been carried out in many other European countries during recent years—had a clearly discernible effect in 1952 upon the pattern of Europe's oil trade. More and more the emphasis is shifting from imports of finished products to imports of crude oil. For O.E.E.C. countries as a bloc (excluding Greece, Turkey, Austria and Iceland), there was a total increase in crude oil imports in 1952 of some 15,000,000 tons above the corresponding figure for 1951—and an accompanying drop in imports of finished products of about 12,000,000 tons. It is difficult to over-estimate the importance to Europe's overall economy of being able increasingly to obtain her oil requirements by refining herself crude oil—drawn mainly from the Middle East—instead of having to meet the great bulk of her need by imports of the relatively more costly finished products.

This development has, of course, only been possible through considerable capital expenditure on plant, and it is calculated that Britain's own refinery expansion programme, which has raised our annual capacity from 2,500,000 tonnes in 1947 to approximately 28,000,000 tonnes at this present time, cost upwards of £150,000,000.

Tanker Tonnage

Another contribution made either directly or indirectly by the oil industry to Europe's economy has been the spate of work brought into the shipyards in the form of oil-tanker orders. Last year saw such orders—both from oil companies and ordinary shipping companies building tankers for charter—bring the total amount of work either in hand or on order with the main European shipyards to a point where further orders cannot be accepted for completion before 1957/58.

To conclude, as the oil industry looks back upon 1952 achievements—and upon plans laid then for fulfilment in 1953—it can fairly say that it has discharged its responsibilities to the world as a whole efficiently and conscientiously. It has concluded several beneficial new agreements with the governments of oil-producing countries—as for instance the 50-50 profit-sharing agreements with Iraq, Qatar and Bahrein and the new oil lease concluded with Sarawak. It has expanded its search for fresh oil reserves in all parts of the world and has tirelessly pursued its policy of fundamental and applied research to add to its store of petroleum technology, to improve its production technique, and to enhance the range and uses of its finished products. It is far too early yet to indulge in prophesies over results likely to be obtained during 1953—but if past results may be relied upon as a guide to future prospects, then the oil industry can look forward with confidence to whatever new developments lie ahead.

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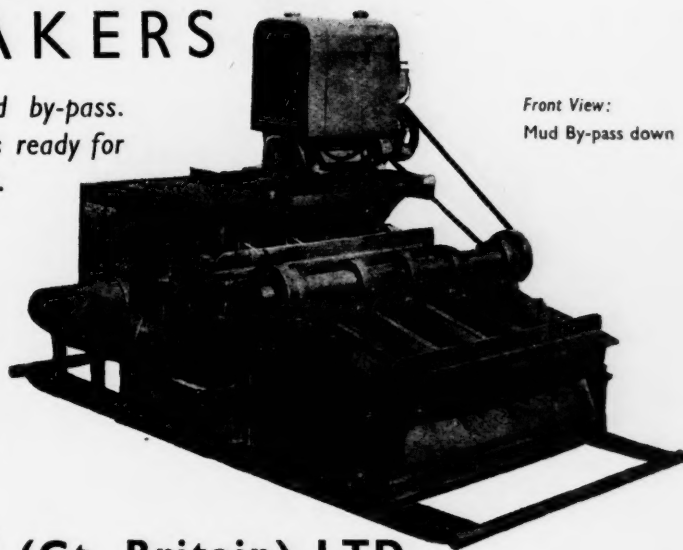
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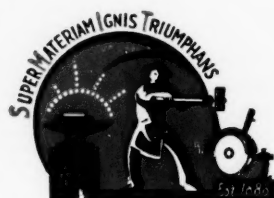
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The Diamond Industry

By a Special Correspondent

THE total sales of diamonds by the Central Selling Organization, comprising the Diamond Trading Co. and Industrial Distributors, were slightly increased during 1952 as compared with 1951 (see Table). A slight decrease was however recorded during the year in gemstones, and the general feeling is that the market for stones is now easing, and that the prospects are improved for a more progressive spirit in the industry once the "hand to mouth" supply situation is over.

Industrial diamonds have again increased in importance (by about 30 per cent as compared with last year) and now represent slightly over one-third of the total sales by value, and no doubt will become an increasingly important part of the industry in the future if the supply position eases and price policy is adjusted more closely to industrial requirements.

Much could be said about the advantages and disadvantages of a monopoly. There is, however, no doubt, that compared with other gem minerals the diamond monopoly has had a tremendous stabilizing influence. An important diamond firm in their market report goes even so far as to attack the American anti-trust laws on these grounds and advocates similar monopolies and trusts in other raw materials, such as metals. Such a suggestion is, however, hardly likely to be taken seriously.

Diamond Production

The 1952 production figures from the world's largest producer, the Belgian Congo, are already available. From the Lubilashi area 10,985,791 ct., mostly industrial stones, were exported and from the Kasai area 530,167 ct., mostly gem stones. Aside from the Congo, complete figures for 1952 are not yet available, but it can be assumed that the total official production will again be higher than that of the previous year, which showed an increase of about 8 per cent over against 1951. Production is thus expanding slowly in response to rising sales and prices, but obviously not to the required extent. Indeed, the reluctance to use available capital for further expansion of South African diamond mining is well illustrated in the formation of the much discussed De Beers Investment Trust, which will presumably divert most of De Beers surplus assets from diamond to gold mining. Other factors may well, however, have contributed to this decision.

Of the big diamond mines around Kimberley the Dutoitspan mine is being refitted, and the Wesselton and Bultfontein mines are in operation. A new recovery plant is being constructed near the old washing plant, which will incorporate a heavy media separation plant and replace the well known "Pulsator" plant. The latter may serve in future for the recovery of old tailings. The Premier mine, near Pretoria, is in full operation with a yearly yield of about 1,000,000 ct., 80 per cent of which are industrials. The recovery system of this mine has recently been described by J. Bone.¹ P. Grodzinski² has given an account of his recent visits to the Kimberley and Premier mines, including a visit of the alluvial digging at the farm Noitgedacht.

The highlight of last year's events was the reconciliation in the middle of 1952 of Dr. J. T. Williamson, owner of the famous Mnadui mine in Tanganyika³ with the central selling organization, represented by Sir Ernest Oppenheimer. Although Dr. Williamson's withdrawal had received considerable Press publicity, it had always been apparent to those closest to the situation that a permanent break with the Central Selling Organization would be quite unthinkable.

A further sales agreement was reached with the main producer of French Equatorial Africa. Nothing of importance can be reported from other centres with the exception of some difficulties with the native industry in the Gold Coast operated by about 17,000 Africans. It has been stated officially that a large proportion of the output from this source is smuggled through French territory into

Nigeria and marketed overseas at cut prices. The Kurupung Placers Co. with the aid of E.C.A. finance carried out detailed prospecting in British Guiana. Considerable diamond mining activity is reported in the neighbourhood of Kurashi Creek.

A. R. Harrison,⁴ consulting engineer to the Anglo American Corporation has given a survey of the relative yields of diamond mines throughout the world from which the following interesting table emerged:

Country	Yield as reported	Yield in terms of standard base of 100 loads*	Yield as ratio of 1 to "X" millionths
Panna (India)	10 ct. per 100 loads	10	36.3
Premier	17 ct. per 100 loads	17	21.3
Angola	0.71 ct. per cu. m.	32.16	11.3
Tanganyika...	20 ct. per 100 loads	20	18.1
Sierra Leone	2 to 2.5 per cu. yd.	118.52 to 148.15	3.1 to 2.4
Gold Coast...	2.5 to 3 ct. per cu. m.	113.23 to 135.87	3.2 to 2.7
South-West Africa.....	7.9 ct. per 100 loads	7.9	45.9

*100 loads = 160,000 lb. = 160,000 × 453.6 × 5 = 362,880,000 ct.
100 loads = 1,600 cu. ft. = 45.29 cu. m. = 59.26 cu. yd.

The diamondiferous gravels of Lichtenburg were described in a brochure by the late geologist A. L. du Toit.⁵ E. Bruet, a French geophysicist gives interesting information regarding a six months trip to the diamond deposits of French Equatorial Africa as a member of the E.C.A. commission.⁶

Diamond Mining Methods

In recent years diamond mining methods have been considerably improved, by heavy media separation, improved grease tables in particular of the band type, electrostatic separation, froth flotation and quite recently A. M. Gaudin⁷ has drawn attention to the possibilities of radioactive separation. These various separation processes have been described in the industry's technical literature by R. S. Young,⁸ A. Linari-Linholm, G. Weavind,⁹ J. Bone¹ and others.

Market Conditions and the Future

Whilst 1951 was considered as a critical year in diamond supply for both industrials and gems, conditions eased considerably both as regards price and supply in 1952.



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Sensitive elements in the trade even feel that a slump is imminent. This, however, would seem to be an extreme view in the light of the supply/demand situation of the world's largest diamond consumer—the U.S.A.

Whilst in 1936 the States was importing 1,000,000 ct. industrial diamonds per year, in 1942, 1943, 1944 and 1947 American imports of industrial diamonds exceeded the world production by several million ct. per year. The United States are now importing industrial diamonds at a rate of about 12,000,000 ct. a year, representing about 86 per cent of the world production. About 1,000,000 ct. go into grinding wheels and other tools which are exported.

It should be remembered that about 30 per cent of the world diamond production are gem diamonds, so that the demand for industrial diamonds of the United States already exceeds available world supplies by 15 per cent, not taking into account the demands of all other industrial diamond consumers. Obviously these demands are having to be met from existing stocks.

In 1936 about 15 to 20 per cent of the industrial diamonds imported to the States were used for diamond drilling, but only 5 to 6 per cent in 1950 and 1951, this shows clearly that the larger diamond imports go to other industries, such as grinding of sintered carbides.

Great strides are being made in the States to reduce diamond consumption by the development of substitutes (increased use of silicon carbide grinding wheels, belt grinding devices, electro-spark and ultrasonic machining), by reclamation of used diamond grinding wheels, and used diamond tools, by recovery of wheel sludge (estimated savings about 5 to 10 per cent of yearly consumption), and by better distribution and allocation of the raw material.

Similar measures seem advisable in all other countries consuming industrial diamonds, and in fact successful reclamation plants appear to have been set up in England,

Germany and Switzerland. Basic information about recovery practices has been made available by the Diamond Research Laboratory, Johannesburg, on behalf of the Central Selling Organization.¹⁰ The industrial reclamation firms use their own and apparently secret methods which are not divulged.

Rock Drilling¹¹

A wealth of material on the behaviour of diamond drills and on investigations into their efficient use in mining was presented at the Diamond Drilling Symposium held in Johannesburg last spring. This is recorded in a special issue of the *Journal of the Chemical Metallurgical and Mining Society of South Africa*. A diamond drilling symposium was also held at the University of Minnesota in October, 1952, at which A. E. Long¹² reviewed the general position of the diamond in mining and related industries.

Important work has been done by the U.S. Bureau of Mines in studying the correct orientation of diamonds in drill bits thus increasing their life and reducing costs. Preliminary investigations by A. E. Long have indicated success in this direction. E. P. Pfeider performed drilling tests with five different orientations of diamond octahedra or combination octahedron-dodecahedron diamonds in EXT core bits. Setting with an octahedral face perpendicular to the direction of rotation and a perpendicular crystal axis showed low tendency to polish, but an inclination of the crystal axis (negative rake of 30 deg.) is recommended as a useful promise. Nevertheless from the practical point of view there are certain objections to this which were excellently summarized by F. L. Christensen. Among the pertinent questions he asks are: What proportion both of new and used drill boart is suitable for orientation? What simple method exists for orientating diamonds which lack discernible faces? As no mechanical

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means for locating hard crystal faces are known, how must personnel be trained to set stones according to correct orientation? How much time will be needed to orientate the 4,000 or more stones on a $8\frac{1}{2}$ in. bit?

For facilitating orientation A. E. Long and C. B. Slawson have suggested that large cardboard models be prepared from which the operator can find the correct orientation.

Oil well drilling with diamond drills, which had not been practised for more than 20 years, was again revived in 1946. F. L. Christensen reported on the progress and economy of this process and showed a number of interesting drill bit designs specially developed to counter the great abrasiveness of sludge.

Diamond coring instructions were given by R. W. Stuart and C. Deely. New core drills were described by H. Hardwell. Sand-blasting was recommended for restoring the cutting power of used diamond drills.

General Survey¹¹

Well documented surveys of the Diamond Industry in 1951, also referring to industrial diamonds, have been given by G. Switzer and W. F. Foshag in English in their yearly review in the *Jewelers' Circular Keystone*, as well as by A. Moulaert in French (*L'Industrie du Diamant*, 1951, Brussels). The U.S. National Production Authority issued at the beginning of 1952 an interesting brochure "Salvage of Industrial Diamonds for Defence," in which specific recommendations are given and a type of works organization is outlined to make the measures effective.

The U.S. Government has introduced some restrictions regarding diamond concentration in grinding wheels and the thickness of the diamond prepared layer. Standardization activities started in England early in the year and draft standards on diamond truing tools, diamond powders, as well as diamond grinding wheels have been circulated.

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Mineral Exploration

By G. A. SCHNELLMANN, Ph.D., A.R.S.M., M.I.M.M.

NO completely new techniques have been reported in the past year, and the mineral deposits which made news have, for the most part, been known for many years but not previously deemed worthy of attention.

Exploration is concerned obviously with the discovery of new mineral deposits, less obviously but scarcely less significantly with the economic assessment of them when discovered; and it is trite to say that a mineral deposit does not rank as an ore body until the second phase is complete. Thus ore bodies are in some cases not so much discovered as created from long-known mineral deposits by an increase in metal prices, a decrease in mining costs, or the discovery of new metallurgical processes and new uses.

The first of these is fortuitous and of uncertain duration; the last three represent real progress: and it may well be from such progress, as much as from discovery in the narrow sense, that future ore reserves will be created. The perfection of cheap block-caving technique has, for instance, enabled the Greater Butte project in the U.S.A. to transfer 130,000,000 tons of rock assaying less than 1 per cent copper from the waste to the ore category; fluosolid roasting followed by leaching has enabled the Kilembe mines in Uganda to take advantage of 0.16 per cent cobalt in a 2 per cent copper ore; and the discovery that niobium forms an alloy possessing properties vital in jet engines has resulted in wholesale working of dumps of columbite formerly discarded from Nigerian tin-dressing operations. There is, nevertheless, general agreement that new ore is not being brought in, whether by discovery or creation, as quickly as present reserves are being exhausted, and it does not need a Senior Wrangler to calculate the answer to that sum.

Two Methods of Approach

Exploration is being currently conducted from two different but supplementary points of view. One argues that ore leads to ore and pins its faith to extensions of known fields. Its strength lies in the logical approach from the known to the unknown; its weakness might be expected to lie in a law of diminishing returns, though it is to be noted that it can claim the Orange Free State goldfield to its credit.

The second school of thought argues for those points of the earth's surface which for various reasons, mostly inaccessibility, have not been thoroughly examined in the past. It has been pointed out for instance that the blank areas on a mineral production map of the world are suspiciously coincident with areas of tropical forest.

Few companies are able or willing to finance geological and mineral surveys of whole countries for so uncertain a return and this philosophy tends to find its practical expression in Point 4 projects such as that now in progress in Portuguese West and Portuguese East Africa. This is estimated to cost \$U.S.2,000,000 and is being financed as to 90 per cent by the Mutual Security Agency, the balance being provided by the Portuguese Government.

Comparable basic reconnaissances are being actively discussed by governments of other undeveloped countries and in the case of Newfoundland, the government (in the guise of a sponsored Development Corporation) is joining hands with mining finance houses. In Uganda, the detailed investigation of the Sukulu phosphate deposits is at present being undertaken on a similar joint basis. Is this union of

public and private funds the shape of things to come? The development of natural resources brings to a country advantages not measured only by the taxation revenue, and with prospecting campaigns costing sums approaching items in a national budget it is not difficult to justify the public sharing of the risk in some measure.

Cost of Exploration

The two schools of thought may be briefly and for evident reasons called the deep and shallow respectively, and regardless of which claims greater support, large sums of money are involved over long periods and at considerable risk. Anton Gray told a United Nations conference that exploration leading to the discovery of the Far West Rand (a deep investigation) occupied six years and cost over \$2,000,000; at Allard Lake, Quebec (a shallow investigation) it required three years exploratory work at a cost of \$500,000 to decide whether the iron-titanium mineral deposits could support a mining enterprise.

The significant thing in both connections is not so much that ultimately the exploration was successful, but rather that initially the type of ore body it was hoped to find justified the risking of money on this scale. Canada's annual expenditure on the search for new ore is stated to be 2 per cent of the value of her mineral production (excluding mineral fuels). No comparable figures are available for other countries.

Exploration Technique

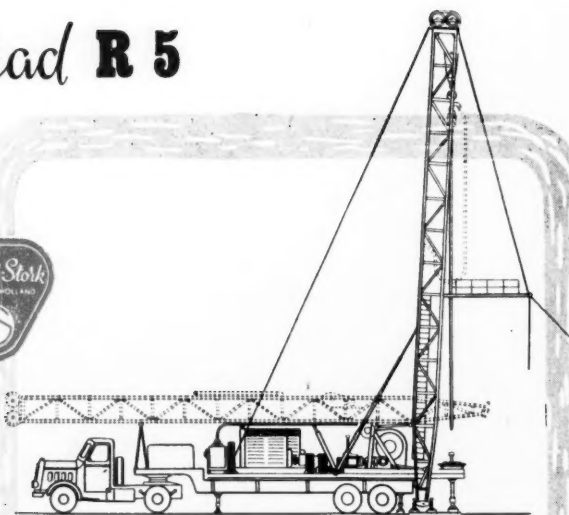
Mineral exploration is conducted under climatic conditions ranging from polar to equatorial; from the tops of the Andes to the bottoms of some of the deepest mines; under conditions of rock exposure ranging from extensive outcrops to complete concealment under thick overburden; and under surface conditions varying from open country to open water. Such variety of jobs demands a scarcely less assorted kit of tools. The old-time prospector is still not without his niche, even within the frame-work of an ultra-modern exploratory campaign, but is necessarily a dying species as the scope for his rudimentary technique decreases. In Canada, their chief if not their last happy hunting ground, most prospectors nowadays attend Government financed schools where they receive basic training in geological principles and learn to read geological maps and literature intelligently.

Increased knowledge apart, the only new tool in the modern prospector's kit is the Geiger counter, and though primarily intended for the location of uranium and thorium, it has also been effective in locating important deposits of fluorspar in Utah. It has been suggested that general studies of the distribution of radioactivity would aid the stratigraphic and structural investigations which are fundamental to the search for all ores, but no very convincing demonstration has yet been reported.

The prospector's hunch and his process of elimination are now superseded by the geology of ore deposits, *i.e.*, the sum of accumulated experience, codified and explained in the light of our knowledge of the general sciences. The ancillary tools of this are aerial photography; ground mapping; geophysics and geochemistry; core drilling; man-sized entry; but the whole pattern is not necessarily applied.

Aerial photography, originally used to provide the

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geologist with basic topographic maps, has now developed techniques by which, under a wide range of conditions, it can supply much of the geological information directly. Not infrequently the air photograph shows geological features which are unrecognizable by ordinary ground methods, but on the whole photogeology is not a substitute for ground mapping. It rather provides a basis on which smaller areas can be selected for field work thus making for efficiency and economy by the concentration of effort, and is standard practice for large undeveloped areas or those difficult of access.

Geological mapping is an art that scarcely offers scope for striking innovations but the tendency to mapping greater detail on correspondingly larger scales is noteworthy. This arises from the increasing realization that structural features are of greater importance than rock species in determining successes.

For the same reason, Canadian mining geologists are reported to be making increasing use of the petroleum geologists' structure-contour method of presenting critical data. At the same time, on the opposite side of the world a leading Australian geologist has declared that this empirical approach does not explain ore occurrence in a constructive manner, and points to more fundamental studies as the new high-road to ore discovery.

Geophysics

After an inevitable reaction due to failure to substantiate extravagant claims made for this new scientific art on its introduction in the 1920's, geophysics now seems to have found its own level. No fundamentally new methods have been devised, but improved design of instruments has increased the sensitivity of observations.

An important development in field application is the airborne instrument, notably the magnetometer, although electromagnetic and radioactive methods are also being operated from the air. Once again there seems to be a danger that enthusiastic salesmanship may dull the sense of proportion. Airborne geophysics does not, as yet, supersede ground methods. Its main virtues are speed and applicability to areas inaccessible to ground parties. Since anomalies are subject to an inverse square law, however, they tend to be smoothed out and rendered difficult of precise interpretation, or even completely lost, by observations more remote from their cause.

Airborne geophysics is at present no more than a detailed reconnaissance method. It may be sufficient by itself in the case of large anomalies directly produced by ore bodies (cf. Bethlehem Steel's magnetite ore body in Pennsylvania, 1,500 ft. below ground), but its more important use is probably indirect in assisting to identify a geological environment within which search by other methods (including ground geophysics) can be intensified. For this reason it is increasingly being found advantageous to obtain magnetometer records concurrently with aerial survey, regardless of the expectation of magnetic ore bodies.

Of the standard geophysical methods which are intrinsically incapable of aerial application, the seismic and gravimetric are in any case least applicable to ore finding; but the latter succeeded in discovering a lead-zinc ore body in New Mexico, and chromite in Cuba.

Geochemistry

Although some of the elementary facts have long been known, geochemistry may rightly be described as the new tool in mineral exploration. Perhaps mindful of the early history of its cousin geophysics, its protagonists have been commendably cautious in their claims. Obviously, like any other tool, it has limitations but it has now been proved sufficiently to give a measure of statistical validity to its results. Not the least factor in making methods practicable has been the development of rapid analytical techniques for field determination of trace quantities of metals.

The application of the method consists essentially of systematic sampling of soils, vegetation or stream water. The analyses of these, when plotted on a map, delineate an area of abnormally high metal values and these define a target for more intensive methods of investigation.

It is in this sense that the current literature of economic geology uses the word geochemistry, but in its broader sense and in another phase, it includes the method recently perfected by Williams & Nakhla for identifying minerals by means of chromographic prints.

The most recent extension of the trace metal technique is to underground exploration. The Tintic operators have been able by its use to distinguish the unmineralized feeding channels of pod-like ore bodies from otherwise indistinguishable barren fractures not related to mineralized ground, with consequent saving in exploration development costs.

Drilling

There continues to be a good deal of misunderstanding of the purpose of drilling and of the significance of its

results. In general, its purpose is to obtain comparatively quick and cheap information about the dimensions, and indications of the grade, of a deposit; only where the values in a mineral deposit are regularly distributed can it be used for the exact assessment of tonnage and grade, and not even then unless the physical nature of the deposit is such that high percentage core-recovery can be obtained.

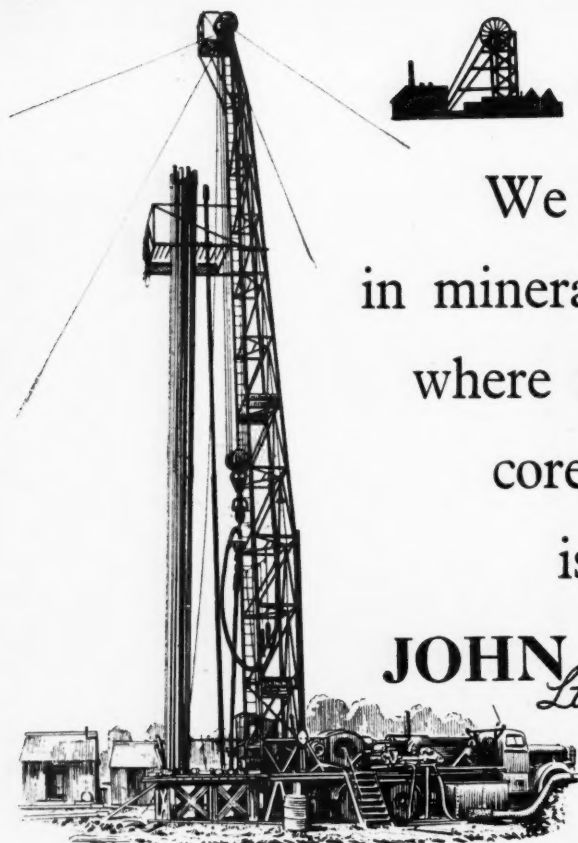
Faster drilling is no doubt desirable from some points of view, but the significant advances are those aimed at obtaining the maximum amount of information, particularly by improving the percentage of core recovered and by plotting the actual path of the hole, which is rarely, if ever, a straight line. Other things being equal, a large core is stronger than a small core and yields a more complete sample.

The technically simplest way of increasing core recovery is therefore to drill larger diameter holes, and three larger standard sizes of holes have been added to the long-established and familiar EX, AX, BX, NX. These new standards give cores 2½ in., 4 in., and 6 in. in diameter



Coverage of an area by aerial mapping

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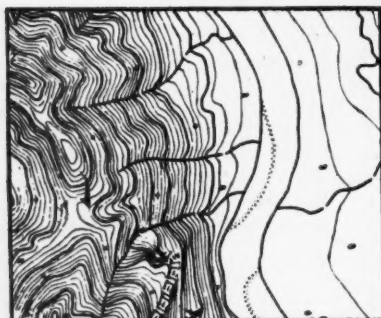
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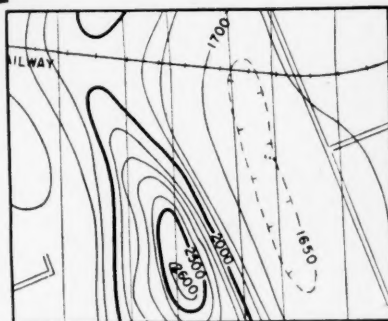
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Associated Companies in Africa, Canada, Australia, New Zealand, Pakistan and South America

respectively. Recent advances in the design of core-barrels and in the barrel-bit assembly have improved the already familiar double-tube core-barrel by causing the circulating water to be discharged through the face of the drilling bit, thus permitting the extension of the inner tube to reach almost to the face of the bit, so that the destructive action of the water on the core is as nearly as possible eliminated. Another improvement automatically cuts off the circulating water when the core blocks.

It is claimed that these refinements have resulted in core-recovery increasing from a maximum of 40 per cent with the standard double-tube barrel to a minimum of 80 per cent with the improved type. These new barrels are not used continuously throughout the drilling of a hole but are substituted for the standard item over critical sections. Where the objective lies at a considerable depth and a series of intersections of it are required, footage can be economized by drilling several holes through the one collar, so to speak. This is done by deliberate but controlled deflection of the original hole, starting from an appropriate point some way down, and is becoming an increasingly popular practice as experience ensures success. Under favourable circumstances several deflections may be made from the same original hole.

The surveying of drill holes is still not as widely practised as is perhaps desirable. This has no doubt been due in some measure to the limitations of the various instruments available for the purpose, but the U.S. Bureau of Mines has devised an ingenious method, based on orientation of

the drill rods, for obtaining both azimuth and inclination from measurements on acid bottle. One great advantage of this method is that it can be used for holes which are too flat for most of the standard instruments, but further field tests are required before its reliability can be assessed.

Disposal of cores is always a problem. Their bulk makes filing difficult, but there is a natural reluctance to disperse material which has been costly to acquire and may well be needed for future reference. Description is much too subjective and selective. Coloured microfilm is now being used to maintain a permanent visual record, while the U.S. Bureau of Mines has announced its intention of

establishing a reference "library" of drill cores. It is to be expected for various reasons that this project will also be more or less selective.

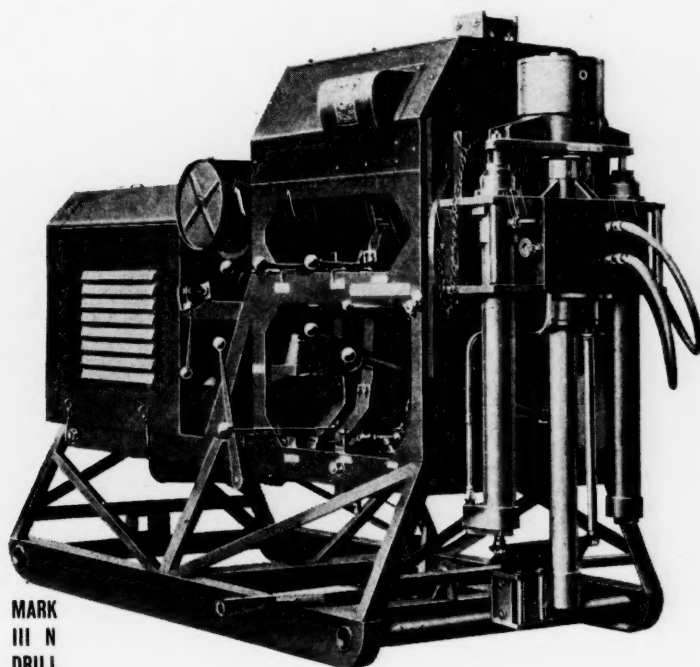
1952 saw no spectacular individual discovery. The large scale development of Jamaica bauxite continued, and further reserves were added to the Labrador-Quebec iron ores. A discovery of manganese

was reported from British Guiana and investigation of its extent was commenced. The occurrence of the columbium mineral pyrochlore in certain Nigerian granites was announced. This discovery was originally made in 1949 but had hitherto been kept on the secret file. It is understood that as a result of the publication, mining houses have not been slow to undertake preliminary investigations. As a sign of new trends and a pointer to future development, this may well prove to have been the highlight of mineral discovery in 1952.



A core recovered by modern methods

(By courtesy of The E. J. Longyear Co.)



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Trends in Metal Mining

By J. B. RICHARDSON, A.R.S.M., M.I.M.M.

DURING 1952 there were no revolutionary changes in metal-mining practice. The larger, richer companies have steadily continued their researches into drilling, blasting and loading techniques and into all phases of mining from shaft-sinking to stoping methods. The fall in market prices of some base metals has sharpened the need to cut costs and maintain profits, but the range of base metal prices generally is so much higher than before the war that even though wages and materials have risen to several times their pre-war standard it is probably only the companies that are mining marginal ore that are seriously affected.

The trends noted last year have continued.

Shaft Mucking

Several years ago a number of ingenious devices were worked out to reduce and, if possible eliminate, the most arduous task in mining—the removal of debris from the bottom of the sinking of a vertical shaft.

Because of the large number of shafts being sunk in South Africa at that time and because of a shortage of suitable labour for that task, excellent work was done and papers published there on the subject. From the same causes coupled with high wage increases, North American mining companies were researching into the same problem. Much progress has been made, the number of devices increased and improvements made both in the mechanisms and the manner of operating them so that it has now become a commonly accepted practice.

The Riddell shaft-mucker employs a clamshell that can reach all parts of the shaft bottom by means of a circular track and for wide shafts a second movement can be incorporated into the carriage. The device has been currently used in a number of countries in both North and South America and South Africa. It is claimed that 22 installations have been successfully employed. Another device, also using a clamshell, is the Hydromucker. The clamshell is of $\frac{3}{4}$ cu. yd. capacity and the machinery can be operated by three men. It has a low capital cost, and is small enough to move through restricted mine openings. Its greatest advantage lies in the use of cage instead of buckets. Mechanical shovels have been tried out for the same purpose but not all the methods evolved have completely eliminated hand loading. An ingenious shaft sinking device, introduced a few years ago, was the "octopus" for introducing concrete from a number of pipes at the same time around the periphery of No. 5 shaft at Van Dyk Consolidated Mines.

In sinking inclined shafts several interesting innovations are reported. The New Jersey Zinc Co. required to sink an auxiliary underground, inclined shaft. The dip of 52 degrees and the shaft dimensions ruled out the use of

scraper loading with a slide into skips. The method evolved was based on the principle of the dragline and a toothed-lip bucket of 13 cu. ft. capacity with hauling and tail rope dumping into a skip was successfully used. The bucket was 18 in. high, 30 in. wide, the top 42 in. long and the bottom 48 in. long. Hauling and tail ropes were hooked on to either end and the bucket hoisted through a stationary sheave at the front. A counterweight was found necessary to prevent overturning. A crew of five men could operate the machine and completely remove the debris.

Drilling

There is no universal combination of drill, rod and bit that will lessen the cost of a foot drilled in all mines because of the infinite variety of the physical characteristics of the rocks to be perforated, but the trend is a more general use of tungsten-carbide tipped bits or rods not only in British metal mines overseas but also in North America as well. Even if the cost per foot drilled

is not reduced there may be sensible advantages because the footage drilled per shaft and thus the tonnage broken may be considerably increased. Small diameter tungsten carbide tipped bits making a near truly cylindrical hole not only effect an overall economy in drilling but in explosives as well. The use of both detachable tungsten carbide bits and carbide tipped steels used in conjunction with light jackhammers and pneumatic pushers is increasing in most important metal mining countries.

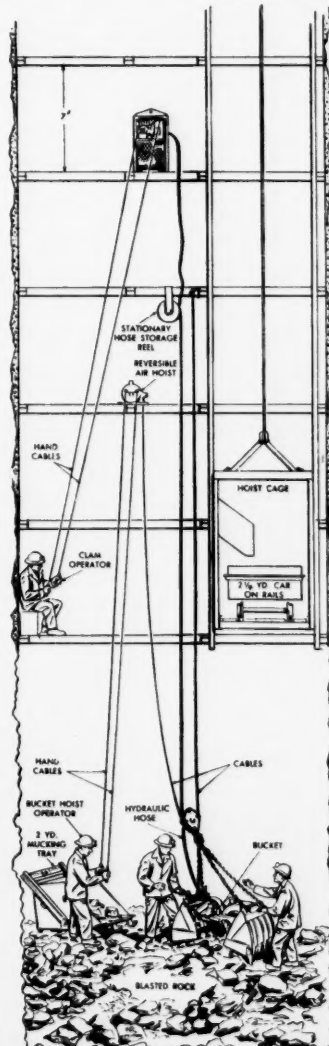
British rockdrill manufacturers were not slow in following the Swedes to produce pneumatically-operated leg supports for light jackhammers and by last year almost every American maker of rock-drills has come out with a pushfeed drill.

Holman Brothers are reported as stating that with increasing experience drillers can now handle a somewhat heavier drill on an airleg than those originally introduced. There is an increasing demand for 2½ in. dia. machines and the improved drilling speed justifies the extra few pounds weight. They have supplied airlegs of 2 in. and 2½ in. dia., the latter for low air pressures, and their latest model is 2½ in.

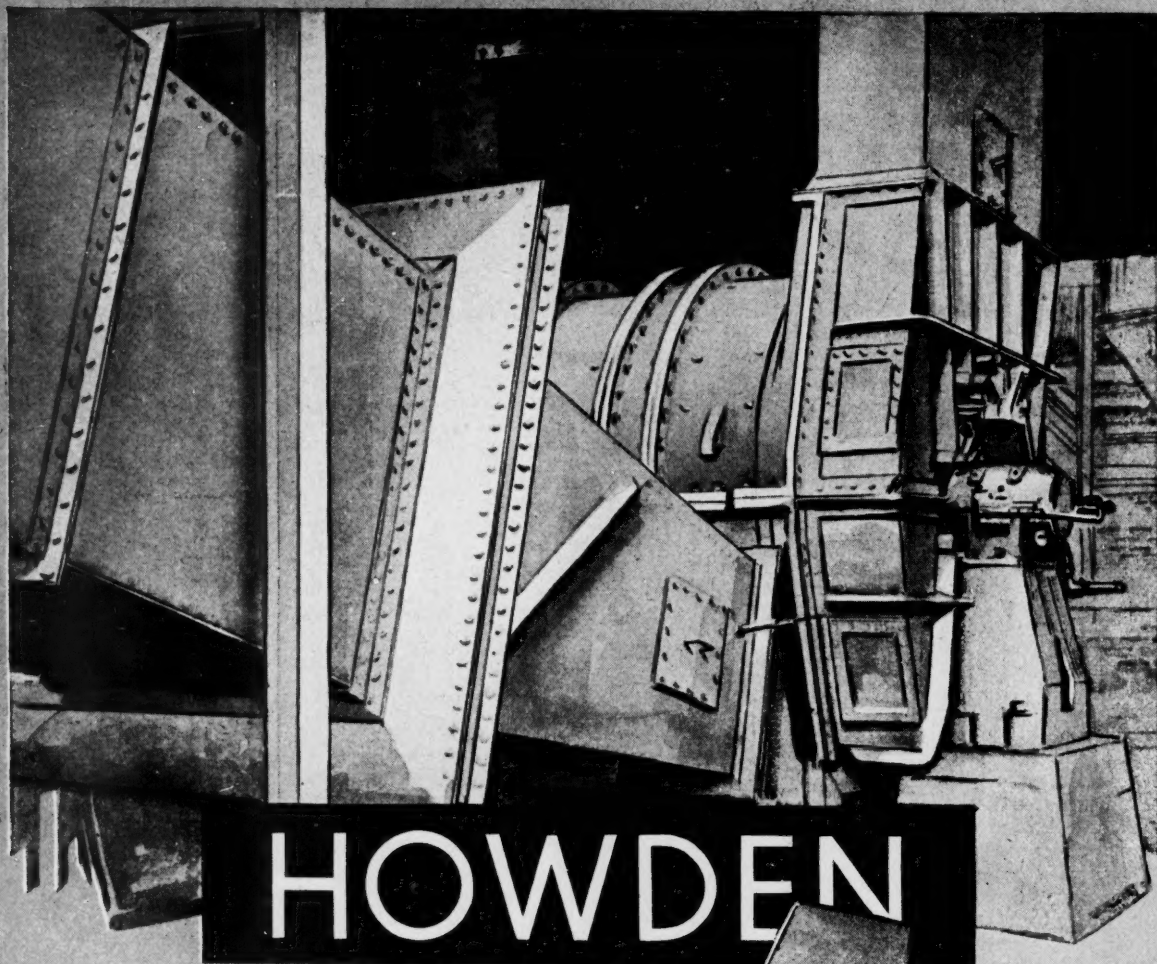
Dust Control

The Dryductor Drill produced just over three years ago is proving itself particularly suitable for raising and overhand stoping where the drill operator is seriously discomforted by dust when dry drilling or by mud when wet drilling. It is also in use for roof bolting when it is attached to an improved stoper leg which by means of a double telescopic leg reduces the machine height to a 32 in. minimum capable of extending to 72 in. The dust collecting device has been improved.

As is well known in this drill the dust passes down an ample cylindrical orifice



Shaft mucking with a Bucyrus-Erie Clamshell

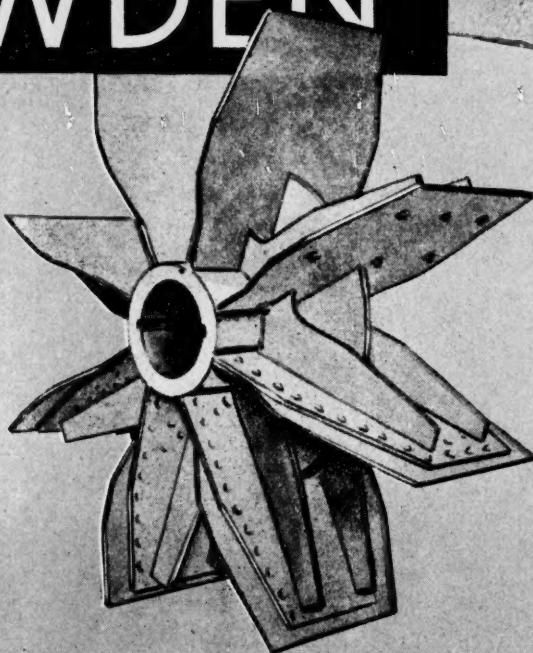


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Right: A typical impeller.



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in the centre of the drill whereas in Germany, where a dry drilling machine has been on the market for some time, the point of dust collection is at the rear end of the drill rod which, though it avoids the passage of dust through the length of the drill, necessitates a change of direction in the flow of rock particles.

Ingersoll-Rand claim to have produced the first rockdrill especially designed for an airleg. This J.R.38 uses rods of $\frac{7}{8}$ in. hexagon alloy steel and can do duty as a drifter, stope-hammer or jackhammer. It weighs 88 lb. and the pushfeed does not have a separate hose.

Gardner-Denver have produced a light weight airleg drill for use with carbide bits, which can be converted from dry to wet drilling by changing only the backhead gland and tube.

Atlas Diesel have extended their range of drills to meet more varied conditions and have introduced a lighter machine, R.H.571 and a heavier one R.H.754 as well as their standard R.H.656 which has been modified.

In a paper read before the Western Division of the American Mining Congress at Denver, toward the end of September last, the mine superintendent of the Homestake Mining Co. reported that his company has carried out a fairly comprehensive five year research into drilling methods and has reached the conclusion that they can now envisage "a general purposes drill that the mining industry may use more or less universally as a stoper, drifter or jackhammer."

Pros and Cons of Tungsten Carbide Tips

Tungsten carbide tipped bits have replaced single use steel bits in every kind of drilling. This change was not because the cost per foot drilled was lower, it was in fact higher, but because greater production per man shift lowered the cost per ton. Recently in an 8 ft. by 8 ft. section drift lightweight jackhammers with airlegs, $\frac{7}{8}$ in. hexagon rods and $1\frac{1}{2}$ in. tungsten carbide tipped bits drilled the round quickly enough for the complete cycle of mucking, drilling, blasting, pipework and trackwork to be done in one shift. In raises, the greater drilling speed allowed a longer round, the blasting of the whole round at once and the completion of the whole cycle within the shift.

Footage drilled has improved by 50 per cent and what is most important, the miners prefer the lighter equipment to handle especially as it also increases their earnings.

In contrast to these findings some managements have gone back to multi-use steel bits because the tungsten carbide tipped bits are too expensive in their particular ground and do not give the expected advantages. In some South African mines and in a Canadian mine where the P.M. bit, of British origin, is widely used, consumption has been reduced by over 20 per cent by regrinding cold on a tapered stone with no heat treatment. In Canada three to four re-usages are expected.

In mines where the rock hardness is highly variable, bit manufacturers have supplied multi-use steel bits and carbide tipped bits that are interchangeable so that when hard or highly abrasive ground is met with the carbide tipped bit can be used until rock easier to penetrate has been regained. In many mines more than one class of bit is in use and drifters are still retained.

Some Current Experiments

In the Tri-State lead and zinc mining district (the home of the two-drill, long-feed, trackless, mobile jumbo) jackleg mounted drills have been used experimentally and have increased the footage drilled per drill shift as well as greatly reducing steel breakages, but according to recent reports, it is too early to predict that there will be a change over to light machines.

In the iron mines the experience is that $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in. bits, presumably tungsten carbide tipped, on $\frac{7}{8}$ in. hexagon alloy steel rods in a light, newly designed $2\frac{1}{2}$ in. machine, which gives faster lighter blows have a 50 per cent longer life without any noteworthy alteration in speed of penetration. From the same district come reports of pear-shaped shanks that last four or five times as long as types previously used and are easier to forge and treat. In the diamond mines of South Africa, where in the Blue Ground it is essential to drill dry, stopers are modified to suit low roof conditions by fixing the drill to the side of the extension leg thus giving a much more compact tool essential for their special purposes. There they are also trying out Holman's newly-introduced rotary drills. These are light weight and mounted on a single column and in the Blue Ground are presumably flushed by compressed air. They are also being tried out in the Copper Belt.

Flat ribbon-shaped hollow steel which will bend in order to introduce it into long holes under low roof conditions is an innovation that is interesting. No reports of long trials in practical mining conditions are as yet available.

At the Denver Mining Congress alloy steel manufacturers stated that the all purposes hollow alloy drill steel had yet to be produced.

Alloy Steel versus Carbon Steel

As the trend towards smaller section hollow alloy drill steel continues it is more important than ever to follow the recommendations for forging, annealing and tempering made by the steel manufacturers. The percentage of alloy steel in use in mining is steadily increasing.

The cost of alloy steel is not so much greater than carbon steel but in certain cases it has been enough to induce the mine management to weld together short lengths of alloy steel to make up a rod. Apparently the technique of welding is extremely successful and failure at welds is small but the principle seems wrong as it is difficult, if not practically impossible, to check the fatigue life of each short steel so that the life of the welded rod is the life of the oldest part. When a new insert is placed in the forged bit the rod fails long before the insert's useful life is completed. However, such welded rods are claimed to last over 100 ft. of drilling in hard rock. The difficulty is to match rod and insert or rod, bit and insert with equal length of life under all the variable conditions presented. Many managements still stick to carbon steel but in harder rocks and where large scale comparative tests have been carried out the results tend to show that the use of alloy steel is justified.

A rule of thumb figure for when to replace steel bits by tungsten carbide bits is when drilling speed, with other conditions equal, falls to under 10 in. a minute.

Generally, recent experience shows that the gain by using tungsten bits is not so much a lessening of cost per



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foot drilled but lower cost because the greater footage drilled allows more ground to be blasted per man shift. Again the combination finding increasing favour is $\frac{7}{8}$ in. hexagon alloy steel with a small tungsten carbide bit used with a fast, rapid hitting light machine. The advantages are not only in speed of drilling and better blasting but in easing the driller's task.

Rockdrill manufacturers are constantly looking for means of improving drilling efficiency and the main improvements sought are stronger connections for detachable bits, alloy steels to increase the life of rods and lighter and more powerful rockdrills. Balancing the drill, rod, bit and air pressure to get optimum result is still the job of the mining engineer.

Long Holes

Owing to the high cost of diamonds, there has been much interest shown in the use of the heavier type of hammer drills with tungsten carbide bits for drilling long holes to replace diamond drilling. Studies made at one mine suggest that where excessive length of hole is not required, where the use of the diamond crown is less than 75 ft. and where a two-man crew is needed the $2\frac{1}{2}$ in. tungsten carbide insert can be usefully employed. At that mine the indications were that the limit in the length of hole drilled by carbide bits is about 60 ft. Percussive drills are satisfactory for holes above the horizontal where sludging is aided by gravity but difficulties arise in successfully sludging long down holes. Northern Rhodesian copper mines find the same difficulty so that for the percussion-drill tungsten-carbide-insert combination to compete with the diamond drill the system of drilling and spacing of holes must be changed.

Although 60 ft. has for a long time been considered to be the average practical limit for long hole percussion drilling, recent experiments have shown that using this equipment with carbide bit holes up to 100 ft. long can be drilled under favourable conditions. In one Ontario mine tests were made to compare diamond drilling with both a 4 in. drifter with 1 in. round rods and 2 in. carbide bits and a $3\frac{1}{2}$ in. drifter using locally made rods and $1\frac{1}{2}$ in. carbide bits. The average length of hole was 50 ft. and the costs with the percussion drill combinations was less than for diamond drilling.

Coupled alloy steel rods with carbide tipped bits are used for holes of varying length in sampling stope walls to find assay limits but this practice was already common between the wars with ordinary percussion drills, carbon steel and steel bits in hard and sometimes silicious limestone.

There is room for improvement in this kind of underground equipment especially in the reduction of size of coupling without weakening the connection so that smaller bits can be used or more ample clearance for rock chip-pings provided.

One engineer on one of the world's big copper mines is of the opinion that the answer to this problem is a specially designed rotary drill with a better bit or crown tipped with carbide or a hard metal of a "cermet" type.

Long hole drilling is used to drill the undercut in block caving. Holes are drilled radially from both sides of a steel supported transfer drift to depths of from 55 ft. to 80 ft.

The rods are 3 ft. long. Drilling in hard to medium hard ore is done by a 12 h.p. C.P. rotary drill using a $2\frac{1}{2}$ in. tungsten carbide tipped bit with a $\frac{7}{8}$ in. hexagon shank. The speed of penetration is given as just over 8 ft. a minute.

Two important symposia were held during last year on diamond drilling, one in April, 1952 in Johannesburg and the other at the end of the year in Melbourne. In both cases papers were presented on blast hole diamond drilling.

Blasting

Ignitor cord has the advantage of only one lighting to fire an entire series of holes. Two varieties are available, one burning at $8\frac{1}{2}$ sec. a foot and the other burning at 17 sec. a foot. Electric firing, which should be obligatory in all development faces, has helped to concentrate rock-bursts at one mine in off-shift periods and at the same mine the use of short delays is expected to reduce the number and severity of bursts.

Better fragmentation in stopes through the use of short delays is reported from a number of mining centres in Sweden, Central and South Africa and North America. The technique of blasting a fan of long holes in parts instead of the whole slice in one blast gives better fragmentation because there is less broken ore as a cushion and concussion is reduced. Short delays by lessening concussion reduce the disturbance to the walls and backs of stopes resulting in less scaling and less dilution.

In one mine, short delays for individual holes have been replaced by cordtex and short delays for each ring or part of a ring of holes fired in proper sequences in long hole blasting. There was no increase in cost, and the method gave faster loading and greater safety.

The use of long waxed paper or cardboard cylinders up to 5 ft. in length is spreading for loading long blast holes. Hot wire fuse lighters

and plastic pipes for blowing out long blast holes and tamping the explosives in them are interesting to note.

Support

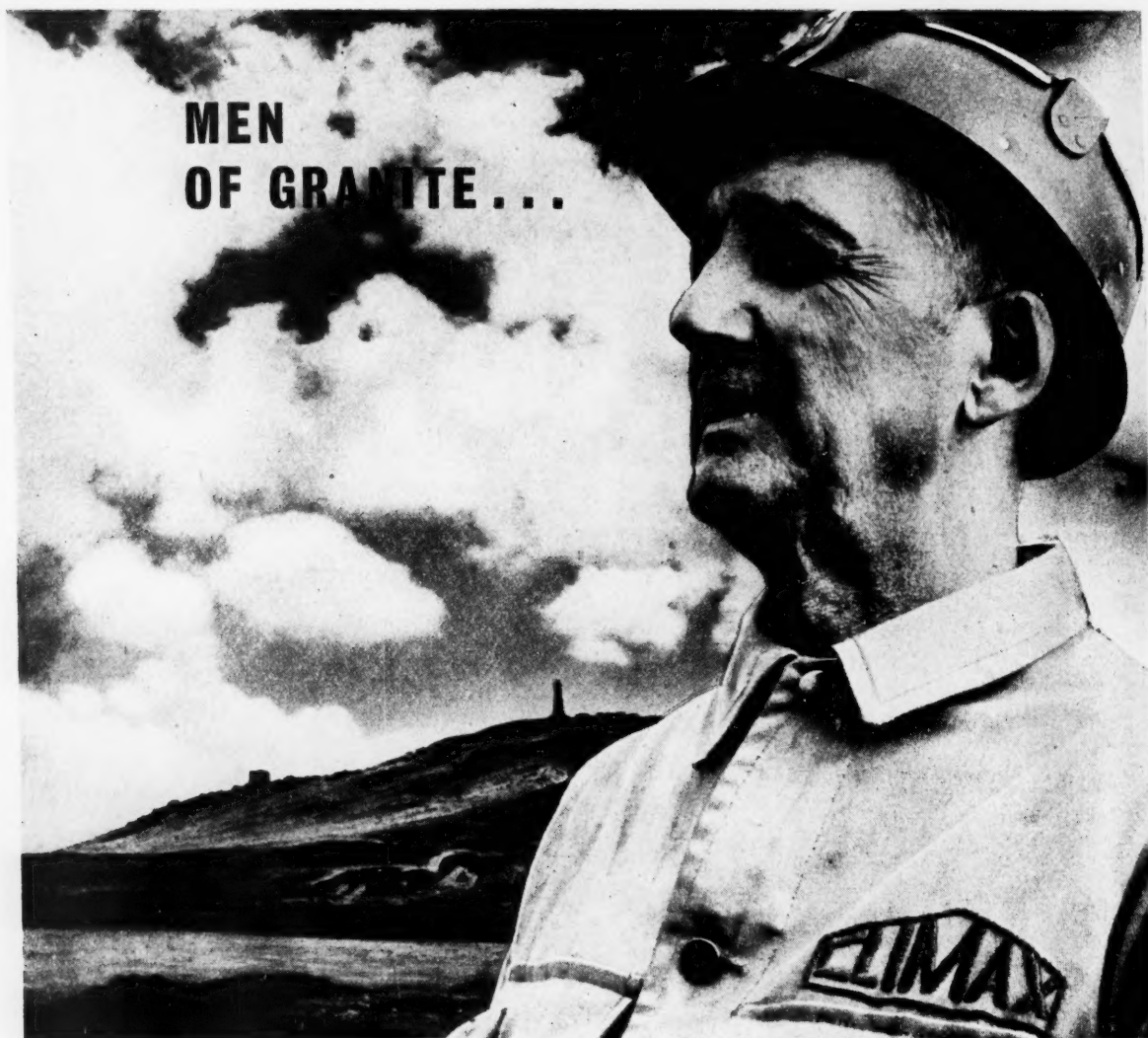
As timber becomes more expensive so is the practice of roof bolting or pinning spreading. Its use is not confined to wide openings such as stopes with weak backs but is used in drifts, crosscuts, raises, shafts and pockets. The main type of bolt in common use is the split rod and wedge of 1 in. dia. in lengths of 3 ft., $4\frac{1}{2}$ ft., 6 ft. and 8 ft.

Specially adapted stopers with constant pressure telescopic feed and central control are made by both British and American manufacturers with the stoper leg to the side of the hammer drill so that they can be used in close conditions and under low roofs, but where there is head-room ordinary stopers can be used. The use of such bolts where the roof or hanging wall is thinly bedded is clearly advantageous as it consolidates thin layers of rock into a thick beam. In a drift with extremely slabby rocks above it a fan of bolts were put in at right angles to the length at $2\frac{1}{2}$ ft. centres with a spacing of 4 ft. between each fan of holes with entirely satisfactory results.

Ease of manipulating machines and improvement in ventilation are gained in addition to the economy in timber. The appreciation of the benefits derived will doubtless lead



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to continued research but its use in metal mining is to date far behind its use in coal mining. If it is used in British metal mines overseas little or nothing has yet been published on the subject.

Steel and concrete are further replacing timber as the cost of good mine timber increases.

Haulage

Diesel locomotives have been used in European metal mines for thirty years and in this country for over twenty but their use in North America both in the U.S.A. and Canada is still a highly controversial subject. In Europe no fatality has been attributed to toxic gases nor have underground fires or explosions been provedly caused by the use of such equipment. Such being the case it is curious that there should be opposition to the use of Diesel-driven equipment underground in those two countries. As long as adequate scrubbing or conditioning of the exhaust gases is provided and carefully maintained and the use of Diesel-driven equipment is limited to areas where there is ample ventilation its use is demonstrably successful with definite advantages over electric locomotives whether battery or trolley-wire operated.

Where the tonnage to be transported is large then troughed belt conveyors of widths over 30 in. may be cheaper to operate than conventional truck haulage. Provided proper lubrication and good housekeeping are maintained, low costs with conveyor belts can be guaranteed. Wet or dusty conditions increase the need for close attention. Records show that lost time and fatal accidents due to belt haulage are remarkably low.

They avoid the employment of loco-drivers, brakemen, platelayers and so on as well as the constant replacement of sleepers, spikes and rails. But the original investment is high and no belt can convey both ways, so that in a mine needing large supplies of timber not to mention other materials, the belt has to be supplemented by an auxiliary truck haulage system.

Because of the high tonnage outputs required, conveyors have their widest application in coal mining, both in Europe and America—more especially in drift mines.

Conveyors are replacing track haulage in some larger metal mines and a number of important installations are projected but for smaller mines the tonnage produced does not often justify the high initial cost of purchase plus installation. In this country a 30 in. or 36 in. belt with drives will probably cost between £4 and £5 a foot installed, if three or more ply rubber belting is employed.

There is, however, a cheaper form of conveyor, the cable belt conveyor which consists essentially of two wire cables which take all the strains and stresses and cradle a thin belt which performs no other function than to support the load. The belt suffers no friction or abrasion on idlers.

Trackless haulage underground is much to the fore in large open mines in North America such as the flat lead-zinc deposits in the Tri State area, but it finds little application in overseas British mines because of different conditions.

Filling

Hydraulic filling is steadily finding new applications because of the ease with which it can be introduced, the large saving of labour compared with hand filling methods and because it has a lesser coefficient of compressibility than other fills including pneumatic filling even though it cannot always completely fill the cavity as well as the latter method. A prerequisite is a suitable waste mill product or a local deposit of sand or fine glacial drift.

Pumping

An advance in pumping technique is the use of totally submersible pumps not only for dewatering wet mines but

also in conjunction with deep shaft sinking. As regards the latter, the pump unit between the lowest pumping station and the shaft bottom must fulfil the following requirements: (a) It must work under the wettest conditions; (b) It must have non-overloading characteristics and be capable of pumping at capacity from heads of 50 ft. to 1,000 ft.; (c) It must be light, compact and easy to handle.

The submersible borehole pump complies with these requirements. It has no exposed motor to drown, it can be operated by remote control, it can be submerged several hundred feet, the trouble free bearings require no external lubrication, there can be no leaky suction and it occupies minimum space. It does require, however, to be kept clear of a sump bottom and to be fed with clear water only. This type of pump had great success in dewatering shafts being sunk in the Orange Free State.

Mining Methods

The most recent of the major standard methods of mining is block caving which has for long been practised in the low-grade copper mines of the U.S.A., but it is not usually remembered that it was first introduced in the iron mines of the Lake Superior district just before the turn of the century. More recently the method has been adopted in many parts of the world, including a number of British overseas mines where the physical characteristics of the ore and the superincumbent rocks to surface are suitable, that is, where both ore and rocks break up satisfactorily to ensure a steady rupture and where the barodynamic effect on both materials has been carefully studied.

The method usually demands large expenditure in block development but this varies widely from mine to mine. In one case with concreted draw points and scraper drifts the ore is discharged directly into cars on the main haulage drift with no transfer raises at all. By contrast in another mine development entails the construction of a complicated system of branched transfer raises of sufficient length to hold a day's supply of mill feed. In many mines block caving was only adopted after other, more costly, methods had been applied and where the technical staff had the time and ability to study the problems involved.

There is a trend to increase the size of the blocks, also for concrete to replace timber as well as the use of conveyors to reduce the number of transfer raises and thus reduce the cost of development. Again rising timber cost and increased wages are responsible for the adoption of caving methods to replace top slicing.

The increase in volume of rock when it is broken has been utilized in Northern Rhodesia to assist in relieving the stresses on pillars and to control subsidence by breaking the hanging wall rock by means of a system of long blast holes. This method can also be used to prevent or to reduce the occurrence of rock bursts. The broken rock exerts an upward thrust to counteract the weight of overburden.

Where good timber is not locally available or is increasingly expensive methods are being sought to modify or replace square set stoping. With falling prices, base metal mines using this method must be carefully studying alternative methods.

Small scale tests on models is being applied to the behaviour of rocks under stress and is the adaptation of well-known research and testing techniques from other branches of engineering. Some interesting work has recently been carried out on these lines and reports are being prepared.

An interesting article published in the middle of last year by a member of the Longyear Diamond Drilling Co. sug-

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gests that mines, like industrial plants, are capable of being pre-designed and not left to extend haphazard.

The basic points were:

- To select and layout the best stoping method.
- To design the gathering of the broken ore, stope ventilation and access.
- To design mine transport and mine ventilation.
- To estimate all costs.
- To schedule the steps in underground development and gear the surface construction to it.

The Orange Free State mines were cited as an extreme case of advanced pre-planning. Of course the shape and content of all ore bodies cannot be predetermined completely and accurately by diamond drilling, but where it can, the intelligent interpretation of cores other than assaying to find the mineral content can aid pre-planning. In fact, this has been done for several years and especially in Canada.

Surface Mining

An important trend is the introduction of electrically-driven rotary drilling units to replace compressed-air driven percussion drills for making blast holes. A self-contained mobile unit has been recently described which is in use at a British ironstone mine. The unit drilled holes up to 40 ft. in depth and was operated by one man who performed all operations unaided and moved the equipment to the next site for drilling with no outside assistance. Tungsten carbide tipped bits are used and it is claimed that labour costs were considerably less with more tons of ore broken.

In America rotary drills have been on trial for two years. Tungsten carbide insert bits are used and it is claimed that even in a hard quartz formation drilling was rapid and without any excessive bit wear. In the same country a mobile unit has been under test for transporting a standard wagon drill. The unit is tractor mounted, the tractor engine providing power for driving a two-stage air compressor and for manipulating the drill which can be used for vertical drilling as well as for drilling toe holes.

The advantages of avoiding the customary cumbersome equipment which has to be withdrawn before blasting and re-assembled before resuming drilling gives a fillip to the invention of self-contained mobile units for this class of mining.

Short delay detonators are becoming increasingly popular in surface blasting to reduce concussion in blasting two or more rows of holes apart from the improvements obtained in fragmentation.

Large heavy duty trucks continued to be improved in design especially in braking equipment.

The question of the optimum position of initiation in quarry blasts has been studied by "machine gun" cameras. It was shown that there was a pronounced difference in rock movement and fragmentation between top and bottom initiation. Bottom initiation giving greater confinement would appear to provide better fragmentation, less gases and less fly rock, thus better utility of the explosives.

What is said to be the largest opencast tin mine in the world is at Manono, in the Congo, where 75 ft. high benches are drilled with electrically-driven churn drills,

drilling 6 in. and 9 in. dia. holes with nichrome steel bits. One to 1½ lb. of high explosive break a cu. yd. of ore. Loading is done by electrically driven 6½ cu. yd. power shovels and the ore is loaded into 20 ton, side dumping diesel-driven semi-trailer trucks.

Manpower and Training Schemes

The scarcity of all classes of underground workers and supervisory grades including mining graduates is emphasizing the need for such training. The official learner training courses on the Rand and in the Copper Belt are well known and have been in vogue for a number of years. Because the manual labour there is composed of native races these courses have special features that cannot be adopted completely in other mining districts.

Many large mining companies have, however, devised schemes that last for similar periods, that is, up to two years and they usually include, if not all, many of the

following features. A variety of practical experience in mines and shops as well as a series of talks and discussions covering company organization, policies, labour relations, safety regulations and first aid. Men with some previous experience may have their training schedule reduced accordingly.

In some cases reports are required each time the man is transferred to fresh work or alternatively he has to render a report every three months. At the same time the supervisor under whom he has been working will make a report on him to the management.

In cases where the miners are required to join a union the learner while he works on jobs covered by the union contract has to join the union and is paid the rate for the job. While working on other jobs such as in technical departments he may be paid a monthly salary. The course normally includes time studies, inspections of workings and machines and the study of drilling, blasting, loading and haulage problems. By the time the courses are completed the management has been able to assess the capabilities

of the learner and can select the best for promotion to junior production officials.

Though recruitment of miners in a few districts has slightly improved, generally the problem still remains acute.

Management in most mining countries is alive to the need of organizing proper recruitment drives and to train the new miners for their various tasks, trying to fit the square peg in the square hole.

South Africa has carried forward its schemes for selection tests and the training of boss boys.

Canada is carefully training the new D.P. Canadians in mining and safety under organized schemes. The authorities have found it advisable to avoid men who had mining experience in Europe as they were apt to fail in lung tests and in preference men were sought who had led healthy, open-air lives and were accustomed to fairly heavy work.

It was thought by those investigating the problem that "mining" was not an attractive term to the common man from Europe.

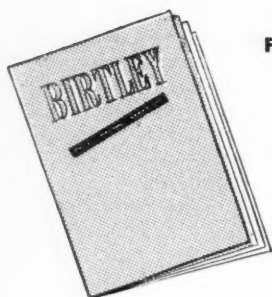


The D.A.5 Siemens-Schuckert drill, as developed for rotary blast-hole drilling

(By courtesy of the Institution of Mining & Metallurgy)

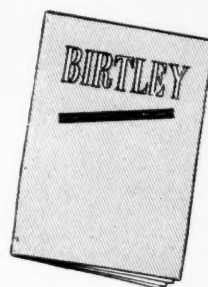
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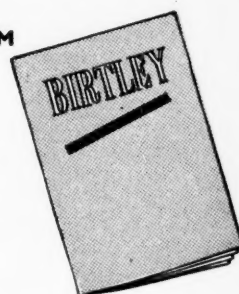
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Progress in Mineral Dressing

By F. B. MICHELL, B.Sc., A.C.S.M., M.I.M.M.

THE year 1952 witnessed no single big development but was certainly one when many new plants were started or designed whilst several of the "largest pieces of equipment" were manufactured and the trend towards the incorporation of more hydrometallurgical methods has continued, more particularly with the development of the "Chemico" process in the United States. A high light of the year was the Symposium on Mineral Dressing sponsored by the Institution of Mining and Metallurgy.

As far as new plants are concerned, the largest number appeared in the field of iron and copper dressing. On iron ores a large number of pilot plants dealing with low grade ores are now operating or are being built. In the copper field, Anaconda's Chile Exploration Co. have started a \$110,000,000 plant at Chuquicamata which will handle 30,000 tons per day when completed and the construction of a new crushing plant for sulphide ore is under way, although at present the existing oxide plant is being used for this purpose. The Nchanga new leach plant has been operating for some time whilst the construction of the Greater Butte Project, mentioned in the *Review* for last year is now getting under way. Another large unit will be the San Manuel plant near Tiger, Arizona, which will handle 30,000 tons daily and the construction of the New White Pine mill for Copper Range is in progress.

Crushing

There is a tendency towards simplification of crushing plants with less closed-circuit operation. In the I.M.M. Symposium on Mineral Dressing a very useful paper was presented by G. Brown on "Crushing and Screening" in which the writer ably summed up the features of each type of crusher and indicated the factors which should be taken into account when selecting them. A number of papers have appeared dealing with impact crushing using the open type of hammer mill or impactor and a type developed in Germany by Hanomag has given most promising results on iron, pyrite and Mechnrich ores.

In this design, the hammers are fixed rigidly but the breaker plates are hinged and arranged around the top of the crusher. A perforated feed plate is used to scalp out fines, provided the ore is dry. It is claimed that selective crushing is the most valuable advantage, whilst it is suggested that the lower efficiency of the older types of hammer mills employing grates is mainly due to the small clearance between the hammers and the grate, so that much material is whirled around the crushing chamber.

At Mechnrich, one impact mill is doing the work of a jaw crusher, hammer mill and one roller mill whilst the selective reduction of the softer minerals produces an enrichment in the fines. Frequently the oversize of a 8 mm. screen is completely barren when lead ores are treated, and the crushed rock is said to have great strength when employed for concrete making.

Screening

The outstanding development is the marketing of the Symons "V" screen by Nordberg Mfg. Co., the prototype of which was being developed during 1951. It consists essentially of a screening surface in the form of a vertical cylinder which is simultaneously rotated and gyrated. Whereas the speed of rotation is 70 r.p.m., the screen is given 980 gyrations per minute so that when the feed is thrown against the inner surface at the top, it passes down

the screening surface in a series of steps, the oversize being caused to drop a short distance fourteen times per revolution, that is each time the screen surface moves away from the material at each gyration.

It is claimed that as oversize particles are held against the screening surface for only a fraction of a second, there is no blinding. Furthermore, the centrifugal action is claimed to make the screen capable of a much greater capacity than usual when gravity alone is relied upon to effect the discharge whilst the wear is low because whenever the feed and screen surface are in contact, they are moving in the same direction and approximately the same speed. The screen can be used for wet or dry working but at present is being made in one size only.

The first application of heated screens for iron ores has been made at the Portsmouth mine, Crosby, Minnesota using a 7 volt A.C. supply with a heavy current flow, a 5 ft. x 14 ft. screen consuming some 39.6 amps. The temperature of the wires averages 180°F. on the two upper panels but only some 75°F. on the lower panel so that the ore is not dried but the wire is kept sufficiently warm that fine ore will not stick to the surface.

In wet screening, a greater use is being made of repulping pockets and the fact that the preparation for non-metallic flotation is often carried out more efficiently by screening in closed circuit rather than by using a rake classifier is now more generally accepted.

This applies equally well to the preparation of an ore for gravity concentration because a classifier circuit contributes to the selective grinding of the higher sp. gr. minerals by overflowing them at a smaller average particle size than that of the lower sp. gr. minerals. In the case of most sulphide ores, this selective grinding favours flotation but for gravity treatment it almost invariably results in a lower recovery. It may also be a disadvantage in the subsequent flotation treatment of low sp. gr. minerals such as feldspar, when overgrinding is undesirable.

In 1951 Mogensen of Dzursholm, Sweden made a new sizer using a series of screens having the same aperture to produce undersize very much smaller than the opening and involving the law of probability. These screens are now in use on an iron mine in Sweden and may prove of great interest as they avoid the use of very fine screens. It is also reported that the ultrasonic screen has been tried since 1950 in Germany and has proved itself superior to the conventional type.

Washing and Scrubbing

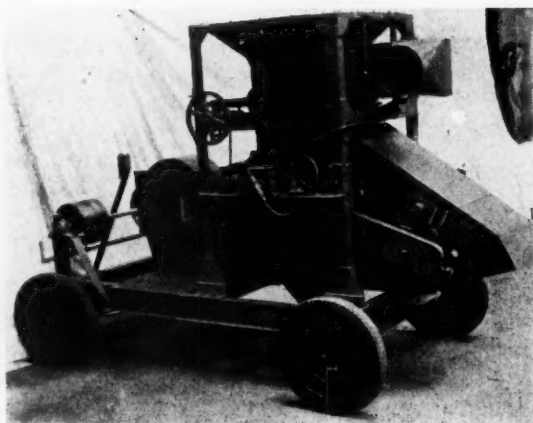
A new type of sand scrubber for glass sand has been described by Mitchell, Kirkland & Edwards¹ which was developed in the Allis-Chalmers laboratories.

It consists of an inclined rubber lined tube in which is rotating a shaft carrying four rubber beaters having weights near their outer edge, so that they scrub the sand flowing through the tube, removing adhering slimes. The original beaters were made from neoprene but natural rubber has been found to be more hard wearing.

Grinding

During the year, the results of the operation of the high speed rod mill at Sullivan and at Lake Shore have been watched with interest and the scope of the open circuit rod mill was discussed most ably by Myers in a paper at the I.M.M. Symposium.²

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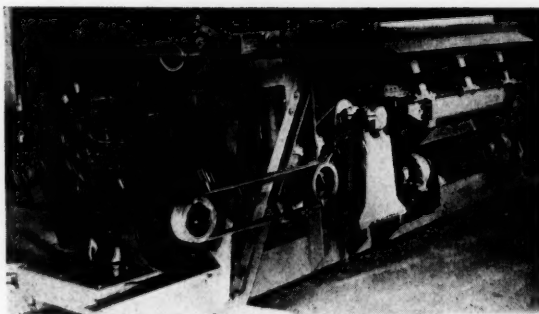


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In this paper the action of the short high speed or "crushing" type of mill as used at Sullivan and Lake Shore is compared with the duty of the lower speed mills at Hayden where the product is finer and more even.

In the case of the high speed mill, the additional speed coupled with high lifter bars produces impact and "scissoring" of the feed, which is much larger, giving a product which is not as even as that produced by the slower mill but nevertheless very suitable for ball mill feed.

In this way, it would appear that the "crushing" rod mill may take the place of the last stage crushing and might be considered to be the successor of the stamp mill when used to reduce a comparatively coarse feed prior to tube milling. It would appear that such a rod mill has certain advantages over dry crushing, when handling a sticky ore.

Not only does it do good work but it does its share of the work of comminution much more speedily than the equivalent ball mill circuit and consequently sulphide surfaces receive a minimum of oxidation during grinding, a factor which may be important in a flotation mill. The "controlled" type of rod mill usually takes a finer feed, often about $\frac{1}{8}$ in. and will produce a more even product in open circuit when the predominant action of the rods is rolling and sliding. The speeds of all these mills is subject to much discussion, however. At the Federal Mill of St. Joseph Lead Co. the rod mill has now replaced rolls and these mills are finding more and more applications in the field of dry grinding when peripheral ports at the discharge end are preferred to a central opening.

Grinding Theory

In May, Fred Bond, of Allis Chalmers, proposed a new theory of comminution which states that the total work input represented by a given weight of a crushed or ground product is inversely proportional to the square root of the diameter of the product particle.³

In his paper, Bond drew attention to the shortcomings of both Rittinger's and Kick's theories and showed that the new approach could be substantiated by figures in practice.

Briefly the formula derived is as follows:

$$W = W_i \left(\frac{\sqrt{F} - \sqrt{P}}{\sqrt{F}} \right) \sqrt{\frac{100}{P}}$$

Where: W = the work input required for any size feed (F) and product (P).

W_i = Work Index or the Kwh/ton required to reduce from a theoretically infinite particle size to 80 per cent - 100 microns.

The values for F and P are the "80 per cent passing size" or the size at which 80 per cent passes, in microns.

Later in the year, Bond also presented a paper for the I.M.M. Symposium entitled: "Mathematics of Crushing and Grinding" featuring an exposition of the use of the above formula as well as calculations in respect of crusher capacities wear, speed, media size, etc. The effect of various factors.

Classification

As far as classification is concerned there have been no new techniques although a great deal of work has been published concerning the hydrocyclone, and Kelsall⁴ of the Mineral Dressing Group of the Atomic Energy Research Establishment, Harwell has made a comprehensive study of the action using a transparent perspex cyclone. One interesting source of inefficiency was found to be the short-circuit flow down the outside wall of the vortex finder and an ingenious means of removing this

middling for re-circulation has been suggested. It consists of an annular take-off around the bottom of the vortex finder, the product from which can be re-circulated.

The use of additional water as in a hydraulic classifier has also been tested in the United States.

The centricone (employing an impeller near the top of the conical cyclone chamber to produce the same effect as the tangential entry at a high velocity) is now being offered by Equipment Engineering of San Francisco. Sharp classification is claimed from 65 to 200 mesh whilst particle size of the overflow can be held under 5 microns if desired.

Gravity Concentration

(a) *Dense medium methods.* The use of dense medium has continued to expand and a new separatory vessel employing a drag to discharge the "sink" product has been put on the market by Wilmot Engineering Co. and is known as the Wilmot-Daniels heavy density unit.

The Dutch State Mines cyclone for fine ore concentration has now passed the pilot plant stage and a number of commercial size plants are under design or construction.

(b) *Other methods.* The Automatic Coal Cleaning Co. have redesigned the automatic control unit in their Baum type of jig washer so that when jigging through the sieve, the amount of air used to create the pulsion stroke is controlled instead of allowing some of the air to leak to atmosphere as a means of regulating the intensity of the jigging action and the corresponding dilation of the ragging.

In coal washing there is a tendency to use lower speeds and 30 to 50 strokes per minute is now common. Tables still remain popular.

Humphreys Spirals are still popular and more have been put into operation. At Trail Ridge, Florida, serious wear has been experienced with an unusually abrasive feed but has largely been overcome by coating the surface with a neoprene paint which is simply sprayed. The coating is comparatively thin, however, and recently it has been replaced by $\frac{1}{8}$ in. thick neoprene cemented into place.

Dry concentration offers considerable scope in certain specialized work and is now extensively used for separating high specific gravity minerals associated with alluvial cassiterite in Nigeria. An excellent review of this work was presented by E. A. Knapp at the Symposium.⁵

In the United States a batch operated high capacity dry blower has been produced by Dry Ore Concentrator Inc. of Redmond, Wash. Dry ore is fed by gravity from a hopper into the body of the machine which is divided into a number of sections and sorted by a steady stream of air, the feed being moved forward by a scraper band operating over the top of the teetering bed. When the sections become full of concentrate, the feed is shut off and the perforated plates forming the bottom of the sections raised slowly so that the accumulated concentrate is carried away by the conveyor and delivered into a separate bin.

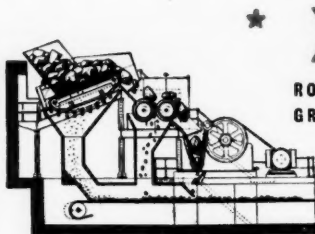
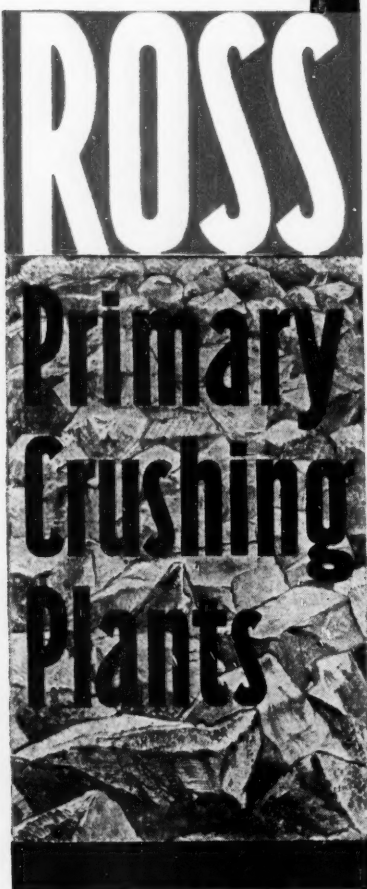
Far from approaching obsolescence, gravity concentration seems likely to stage a "come-back" with the development of hydrometallurgy and the likelihood of lower grade non-sulphide ores becoming increasingly important in the future. In many instances if hydrometallurgical methods could be adopted for low grade concentrates, flotation might not compete with gravity.

Even in sulphide ore dressing there is a tendency to employ more gravity separation and cut the fine grinding and flotation costs, whilst at the Nevada, Massachusetts' concentrator, Tungsten, Nev., recent changes have had the effect of increasing the amount of recovery in the gravity section by alterations in the flowsheet which involve

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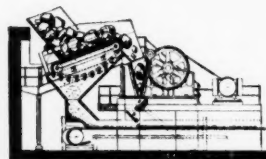
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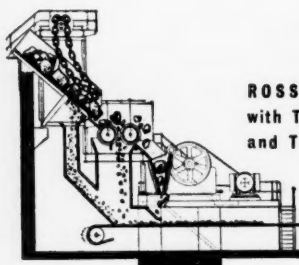
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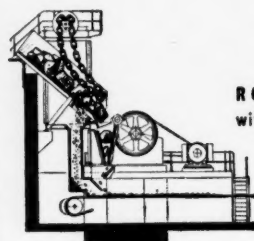
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By these means costs have been lowered and 70 per cent of the tungsten is now recovered on the tables whereas previously almost 70 per cent was being recovered by the flotation plant.

Flotation

Owing to the shortage of pine oil and its rising cost, a number of frothers have come on the market which in many cases have proved superior to pine oil. Amongst these probably the most outstanding is methyl isobutyl carbinol which is marketed by Cyanamid as Aerofroth frother 70 and another new development, Dowfroth 250 which is completely water soluble. Using a synthetic material, it is very uniform in quality and is said to require smaller quantities than most other frothers.

Although it is dearer, the reduced consumption usually effects a reduction in operating costs whilst owing to its water solubility more can be returned in any water recovery system. (Pine oil is actually adsorbed on almost all solid particles in the pulp and much is consequently lost.) Dowfroth has the advantage that it possesses little or no collecting properties which allows independent regulation of both frother and collector, and the merit of this control has been demonstrated at Sullivan.

The properties of frothers has been extensively studied by Wrobel⁶ and his findings may do a great deal to promote a better understanding of the function of a frother and its proper selection. Work on frothing has also been

done in the United States.⁷

Wrobel has also shown that the presence or absence of nuclear gas markedly influences the rate of flotation as well as the recovery and throws a new light on a little investigated factor in flotation.

Cyanamid reagent (S.641), a new froth modifier and auxiliary collector has been effective in scheelite flotation, whilst fatty amines and their derivatives are now being manufactured in Sweden by Liljeholmens Stearinfabriks, their range including many primary amines, their acetates and hydrochlorides as well as certain tertiary amines and quaternary ammonium products. The problem of dealing with oxidized zinc ores by flotation was discussed by Maurice Rey.⁸

Work with radio-active tracers on the adsorption of dithiophosphates on galena and sphalerite has been continued in the Cyanamid laboratories and the results support the earlier finding that a relatively small amount of collector need be sorbed on the mineral surface to promote flotation.

Magnetic and Electrostatic Separation

A new drum type of separator has been produced by Rapid Magnetic Machine Co. in which the field is concentrated by a re-designed magnet system. It is said that it is capable of handling all grades of magnetite and even some of the more susceptible ilmenite. Dings of Milwaukee have also produced a new line of separator of the disc type.

More attention is being paid to electrostatic separation and a machine is now manufactured in England by Sturtevant.



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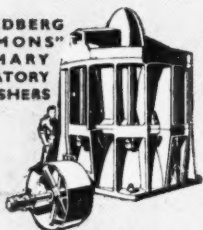
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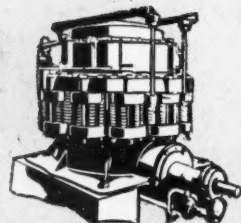
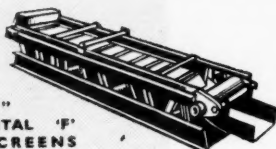
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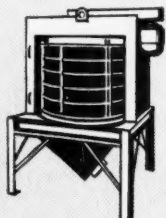
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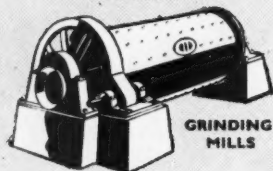
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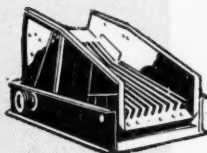
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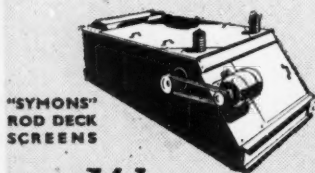
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Mechanical Picking

Attention has been drawn to mechanical picking by the ingenious sorting apparatus developed at the Coal Board Research Establishment⁹ and described by Newman & Whelan.

This apparatus now being operated on a pilot scale is able to separate "bright" from "hard" coal in order to replace hand-picking. It has also been tested on witherite, gypsum, barite, calcite, fluorspar, magnesite, bauxite, chromite and pyrite lump ores.

The process is able to differentiate between diffused reflections and specular reflection so that even when the total reflected light is the same, different surfaces can be distinguished. The estimated operating cost is low, being given as between 0.15d. per ton of feed 3 in. feed size and about 2.5d. per ton at $\frac{1}{2}$ in. feed but capital cost at first sight would appear to be high. Nevertheless, the process has interesting possibilities and may repay examination, particularly where material of say $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. required sorting.

Another variety of "picker" was developed at the M.I.T. to concentrate clean optical fluorspar in the size range - 4 to plus 10 mesh from a feed carrying over 99 per cent CaF_2 and depends on the fact that if submerged in a liquid equal to its refractive index (1.434) it is invisible whilst particles with included impurities give themselves away in the light pulse sent to the photo-electric cell which operates the gate (which does the picking) through an electronic circuit.

Plant Practice

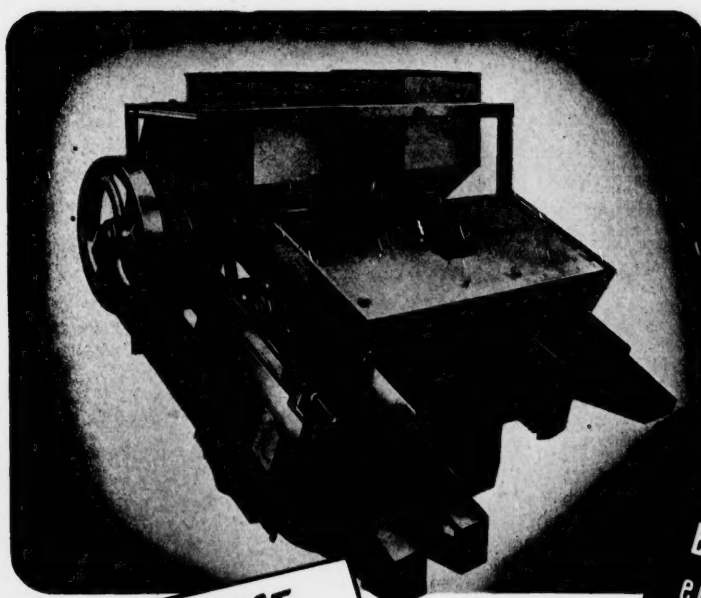
There have been a number of interesting new plants either erected or designed during the year. In the new Copper Concentrator at the White Pine copper project some

10,500 tons should be milled daily. Apart from the use of the largest ball mills in the world (they are 12 ft. by 13 ft.), there are one or two unique features in the flowsheet. For example, the copper will be floated using lime, fuel oil, Minerec B, xanthate and pine oil with one cleaning stage but the primary rougher tailing will be deslimed in a cyclone and the underflow scavenged, the concentrate from this operation joining the cleaner tailing which will then be classified using a cyclone and the underflow reground in ball mills in closed circuit with it. The cyclone overflow will return to the primary grinding and flotation circuit.

The leach plant at Nchanga, Northern Rhodesia, is now in full operation and the details have been described by H. L. Talbot in *Optima* during the year.¹⁰ Nchanga mine has one of the world's largest copper deposits and the ore carries chalcocite, malachite plus minor amounts of chalcopyrite, bornite, azurite, cuprite, native copper and chrysocolla.

After flotation of the sulphides, an oxide concentrate is made carrying 15 to 20 per cent cu. of which 3 to 4 per cent is present as sulphide. This is leached with sulphuric acid in continuous agitators for only two to three hours as the oxide minerals are readily soluble. The pulp is next thickened and the clean solution goes to purification, the copper being finally recovered by electrolysis. Purification is carried out by adding limestone and manganese ore to precipitate iron dissolved with the copper. After washing, the leach residue is ground, the acidity neutralized and the residual sulphide copper recovered by flotation.

When the present plant extensions are completed, Nchanga will have a capacity of about 130,000 tons of metal annually of which some 40,000 tons of electrolytic copper will come from the leach plant.



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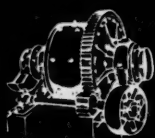
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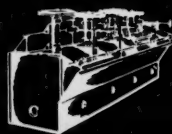
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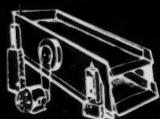
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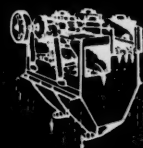


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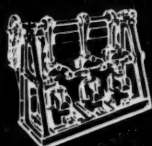


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Lead and Zinc

The treatment of the complex ore at the Tsumeb mine, S.W. Africa have been described in some detail.¹¹ Low oxide ores are treated by conventional selective flotation making a copper-lead concentrate and a zinc concentrate. The high oxide ore is treated in a separate circuit where a bulk concentrate is prepared using a straight xanthate circuit. This concentrate is then treated in a separate circuit where dichromate and reagent 610 are fed to the conditioner, so that the zinc is floated and the lead depressed using two stage cleaning.

Finally, there is a fifth circuit which takes the tailing from the bulk flotation plant treating the high oxide ores. Here the pulp is conditioned with sodium silicate and sodium sulphide followed by flotation, again with two stage cleaning, using amyl xanthate and reagent 404. The concentrate produced joins the copper-lead concentrate from the low oxide ores.

At another mine a process involving deleading the zinc concentrate is carried out by refloatation of the zinc in a pulp with a high concentration of cyanide and zinc sulphate (using as much as 3½ lb. of cyanide and 2 lb. zinc sulphate per ton treated).

An interesting departure from usual practice was tested recently in Australia when flotation on a table was used with considerable success for the removal of arsenical minerals from Broken Hill¹² gravity concentrate after other methods failed, including both grinding followed by froth flotation and leaching. It is stated that so long as proper aeration is provided, a definite split can be made employing conditioning with cyanide and soda ash followed by flotation on a table using xanthate, fuel oil and cresylic acid as collectors to render the large particles floatable. In this way, the arsenic in the lead concentrate was reduced

to 0.01 per cent and the lead losses varied from 0.12 per cent to 0.47 per cent only. This is the first published attempt to employ this variant of flotation on a lead ore although the writer has successfully separated galena and sphalerite by "table-flotation."

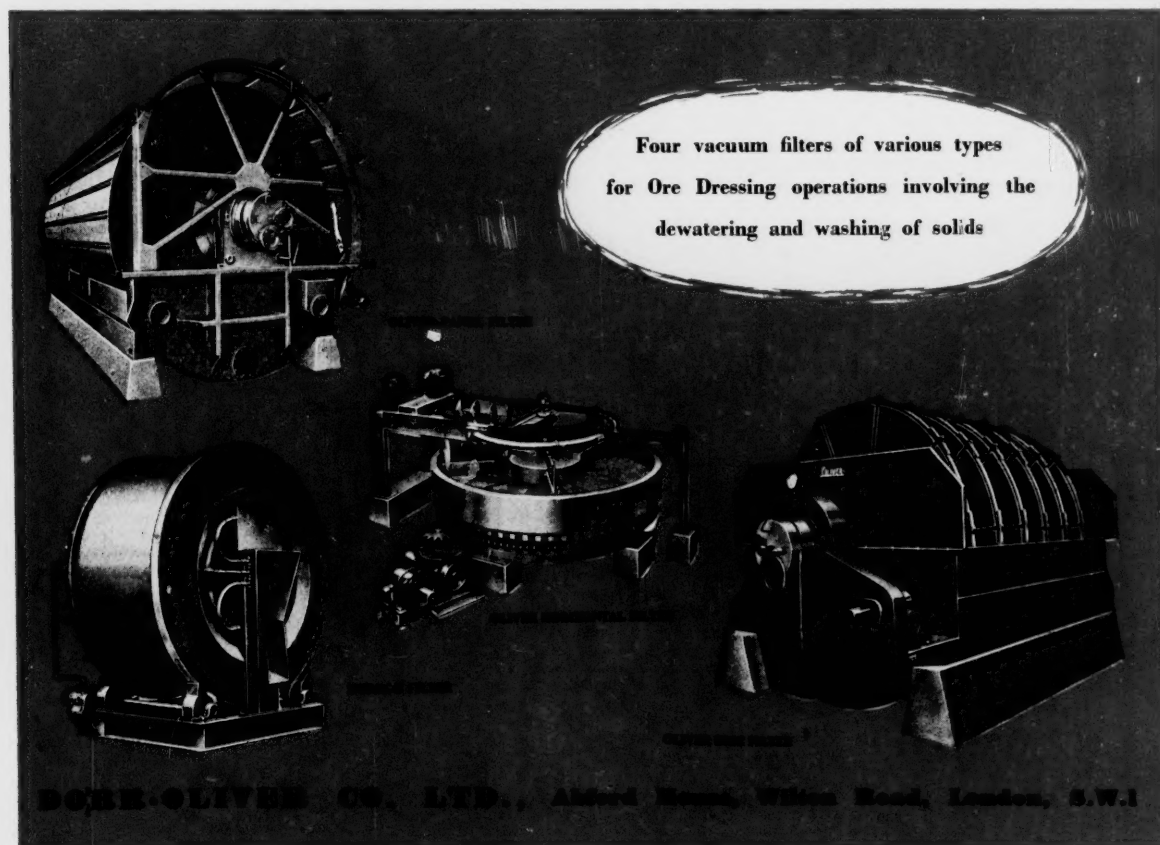
It is, perhaps, worth noting now that the "fashion," for such it was in many cases, of fine grinding and flotation has passed and there is a tendency to investigate the merits of more gravity concentration instead of dubbing it old-fashioned and obsolete; that it is feasible to separate a mixed concentrate of sulphide minerals at a particle size between 8 and 60 mesh by table flotation. Not only does this save grinding costs but frequently results are better than when finer sizes are treated in the normal manner.

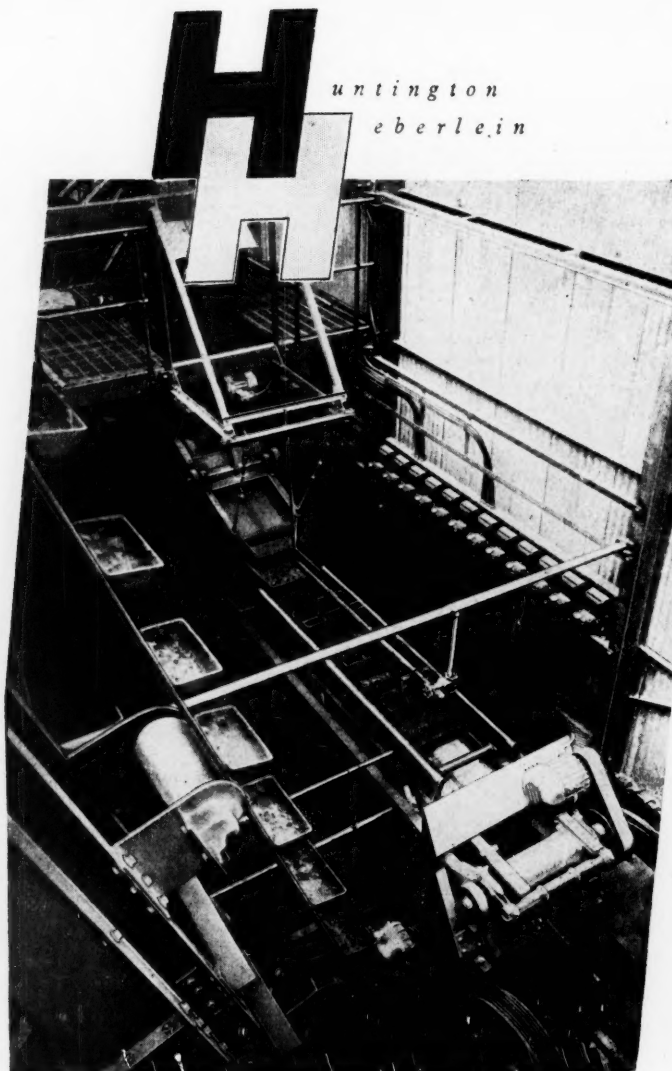
Tin and Tungsten Ores

The operation of a flotation plant for the recovery of wolfram and cassiterite from ores of the Altenberg and Zinnwald districts of the Erzgebirge has been described by W. Finn.¹³ Briefly the ore is dry ground to —150 micron, then pulped with water before flotation using oleic acid as the collector, sapinol as frother with sodium silicate and caustic potash, whilst fluosilicic acid is employed as a depressor for mica and topaz. Overall recovery is about 77 per cent.

The flotation of cassiterite has also been studied by Ewers and Edwards in Melbourne in respect with the adsorption of sodium cetyl sulphate and it has been shown that samples of cassiterite vary greatly in ability to float.

Descriptions of gravity plants treating wolfram in France have been published in *Annales de Mines* (Paris)¹⁴ but there is nothing novel, treatment being by conventional gravity means.





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The use of the tilting frames at Yxsjö mine, Sweden has been described¹⁵ for the recovery of scheelite and variations in the design of the table surface are discussed.

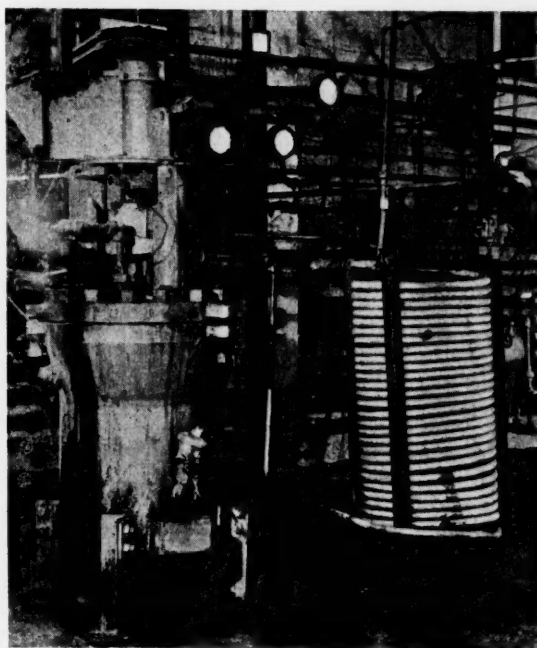
At the Panasqueira mine of the Beralta Tin and Wolfram Co., Holman-Michell table flotation now forms an important part of the flowsheet as described by J. C. Allen.¹⁶

Other Minerals

A unique flotation plant has been erected in Southern California handling 70 tons daily to deal with rare earth minerals. Treatment consists of grinding to 200 mesh followed by flotation involving removal of barite with aerosol and tannic acid followed by rare earth recovery with Armour neo-fats using soda ash or caustic soda for pH control. An acid leaching plant has now been erected to digest the concentrate in hydrochloric acid at 160°F. filtered and the rare-earths precipitated as oxalates by oxalic acid. The oxalate will then be filtered, dried and passed through a small kiln to convert to rare earth oxides.

The first uranium recovery plant in South Africa went into operation at West Rand Consolidated on October 8th. The cyanide tailing is leached with sulphuric acid in rubber lined tanks for sixteen hours using a batch treatment, then filtered, the solids repulped and refiltered. The solution then passes to purifiers where iron, aluminium and silica are precipitated, the solution is subject to ion exchange, presumably to enrich the liquor and the uranium recovered as the oxide. The sulphuric acid is produced from pyrite using Dorr fluo-solid roasters making sulphur-dioxide which is converted to the trioxide with beds of vanadium pentoxide whilst manganese di-oxide is used as an oxidizing agent and is recovered from the sulphate solution after the uranium precipitation as the hydroxide.

The recovery of uranium as a byproduct in processing phosphate rock has been proposed by International Minerals & Chemical Co. in connection with their operations in Florida.



Autoclave and heat exchanger used in Chemicco's powder metals process. (See also page 103.)

(By courtesy of American Cyanamid Co.)

Interest in manganese has caused the U.S. Bureau of Mines to construct a pilot plant at Boulder City, Nevada to test a combination of flotation and hydrometallurgy for low grade ores whilst a number of new processes have been patented for leaching such ores.

It is also reported that the King Mountain spodumene plant is being expanded from 300 to 1,000 tons per day. Here spirals are used to concentrate heavy minerals which are cleaned on tables making a concentrate carrying 45 per cent Sn, 33 per cent columbite, 14 per cent pyrrhotite and

8 per cent monazite. The spiral tailing is then treated to remove the mica and feldspar presumably using cationic collectors, leaving the spodumene in the tailing.

Another interesting plant which is rather novel is operating in California to beneficiate beach sands. The sand comprises equal parts silica and high alumina mineral and is scrubbed to remove slimes in attrition machines, floated to remove iron bearing minerals, then finally split into the quartz rich and the alumina rich fractions by floating using Armour amines with hydrofluoric acid and a frother at a pH of 3.1.

A review of developments in 1952 would not be complete without a mention of the Chemicco technique in the United States in which Cyanamid have taken a big hand. The basic steps are leaching, separation and reduction as in any other hydrometallurgical operation but all are

carried out at elevated temperatures and pressures using autoclaves, and the reduction is carried out in the solution.

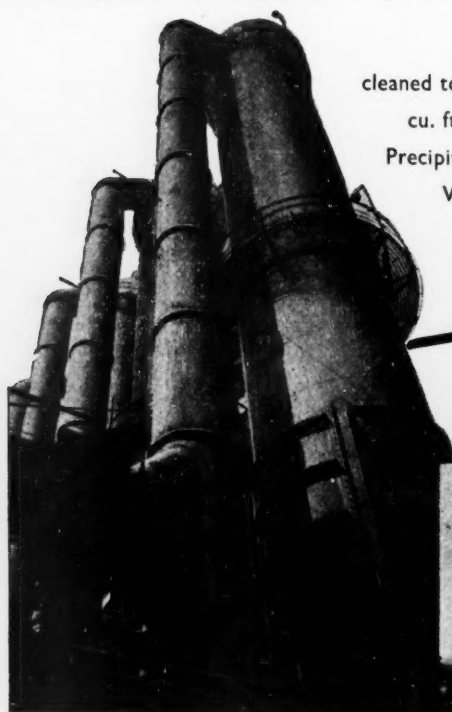
Two plants are under construction using this process one at the Lake Lynn property of Sherritt Gordon Mines Ltd., in Canada, where a process was worked out in the laboratory and the pilot plant for the separation of nickel, copper and cobalt, and the other at the National Lead Company's plant at Fredericktown, Mo. A third plant is now in operation by Howe Sound Mining Co. at Garfield, to treat cobalt concentrates from its Blackbird mine.

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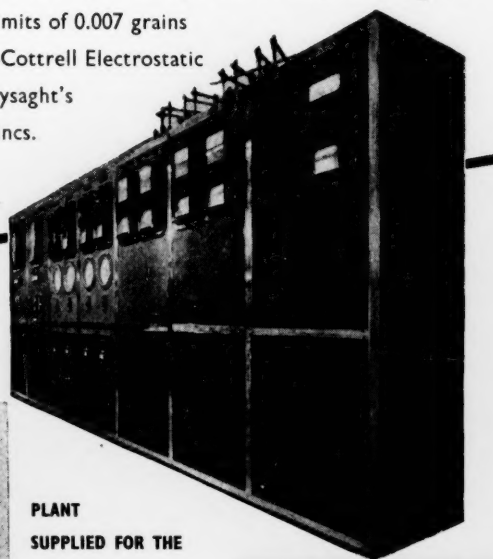
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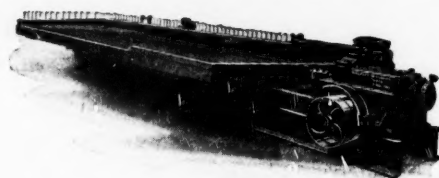
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Review of Extraction Metallurgy

By GRAHAM OLDHAM, B.Sc., F.R.I.C., D.L.C., M.Inst.F.

THROUGHOUT the year numerous developments have again occurred in the field of extraction metallurgy. This review deals, in the main, with what may be termed non-ferrous metallurgy.

Aluminium and Magnesium

In the electrolytic production of aluminium the consumption of carbon anodes is an important contributory



A battery of electrolytic reduction cells

(By courtesy of Alcan, and Northern Aluminium Co.)

factor to the final cost of the metal. The oxidation of the anodes is said to be obviated in a process claimed by L. Ferrand¹. The alumina content of the cryolite bath is maintained constant by continually discharging into it a suspension of alumina in an atmosphere of methane. Admission into the molten bath is through ducts in the anode and the amount of methane is regulated so as to combine exactly with all the oxygen of the alumina.

The carbothermal process for the production of metallic magnesium results in the formation of a mixture of magnesium vapour and carbon monoxide. This mixture must be cooled down to 250°C. in from 0.001 to 0.0002 sec. in order to prevent the back reaction. An apparatus for doing this has been claimed by F. J. Hansgirg². The mixture is passed through a narrow space between the two water cooled discs, one of which is rotated with a surface velocity of 150-1,000 ft. per sec. On leaving the discs the mixture is diluted with cold hydrogen or other neutral gas so that the resulting gas mixture contains only 30 per cent carbon monoxide.

Chromium and Vanadium

A method has been patented by Lloyd and Rawles³ for the extraction of chromium from chromite. The finely ground ore is treated with a stoichiometric equivalent of between 20 and 50 per cent sulphuric acid, together with chromic acid in amount equal to 2-7 per cent of the sulphuric. The reaction is carried out in a pressure vessel at 40 lb. per sq. in. and a temperature of 125-165°C. When reaction is complete, iron and aluminium are first crystallized out followed by chrome alum which is further purified by recrystallization. The chrome alum is used for electrolytic cell feed and the mother liquor, which still contains some chromium, is recycled to the leach stage.

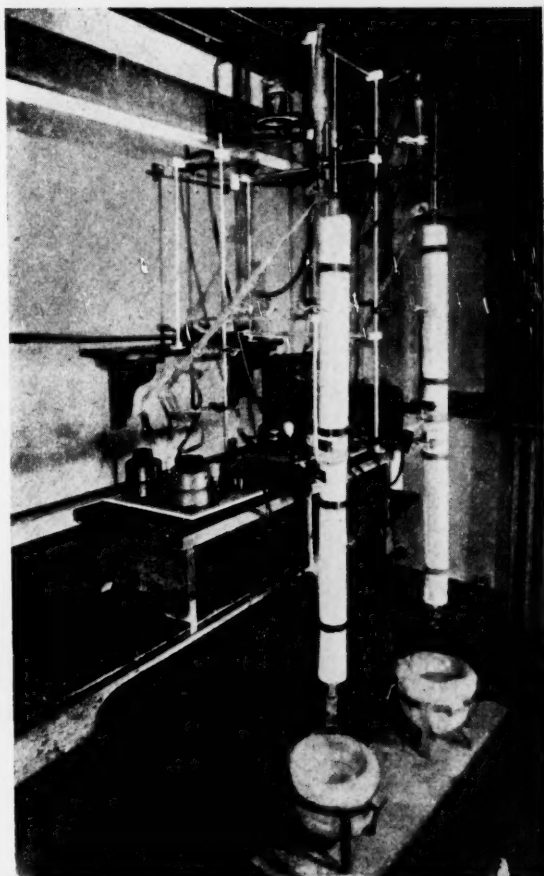
The extraction of chromium and vanadium from chrome ores has been described by Perrin and co-workers⁴. The ores are subjected to soda ash roasting and the leach liquors therefrom partially neutralized. The solution, which

contains 1 part vanadium to 1,000 parts of chromium should have a pH of about 8.5. Lead sulphate is then added and this precipitates the vanadium as lead vanadate together with a small part of the chromium. The liquor is processed for chromate production and the mixed lead chromate and lead vanadate filter cake is extracted with cold dilute sulphuric acid. The vanadium is precipitated from this acid extract by adding alkaline leach liquor until the pH is 2 and then heating to 90° followed by gentle agitation for three hours. The precipitate, a colloidal complex acid sodium vanadate, contains about 85 per cent vanadium pentoxide. The acid mother liquor is recycled and used to neutralize the liquor from the original alkali roast.

Gallium and Germanium

In a method for the extraction of germanium from flue dust described by R. C. Chirnside and H. J. Cluley⁵ the dust is smelted with reducing agents when the iron oxide present is reduced, and the molten iron so formed used as the collector. Some 2,000 tons of metal are dissipated in flue dust every year.

M. Beja⁶ has discussed the various methods which have been proposed for the extraction of gallium oxide from Bayer alumina. The gallium in the alumina is first of all concentrated, for example, by slow carbonation. The



Final stages in the production of germanium

(By courtesy of General Electric Co. Ltd.)

enriched alumina is then treated at room temperature with a large excess of acetic acid when a basic acetate of gallium is precipitated, aluminium, zinc, indium and iron remaining in solution under such conditions. The gallium basic acetate is converted to oxide which is then dissolved in caustic soda to form sodium gallate. Electrolysis at about 30°C. yields gallium metal.

Gallium from Metallic Aluminium

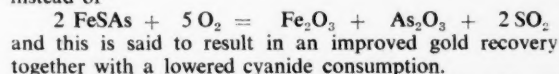
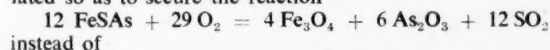
A patent claimed by F. C. Frary⁷ covers the extraction of gallium from metallic aluminium in which it is usually present to the extent of not more than 0.02 per cent. During the electrolytic refining of the aluminium, the gallium tends to concentrate in the molten anode. After cooling, therefore, the anodes are dissolved in caustic alkali and the gallium obtained by electrolysis in the usual manner. The same author⁸ has also claimed a method for the extraction of gallium from materials containing both alumina and gallium oxide. The alumina, which must contain between 0.001 and 0.01 per cent gallium, is dissolved in hot 20 per cent caustic soda solution. The aluminium is then precipitated as calcium aluminate by the addition of lime, the gallium remaining in solution. Gallium is then precipitated as the oxide and redissolved in 14 per cent caustic soda solution. Electrolysis at 175°F. is then carried out, using a current density of 5 amperes per sq. in. and a p.d. of 10 volts. The gallium is deposited on a stainless steel cathode and has a purity of 97 per cent.

Gold

The influence of the roasting temperature on the subsequent cyanidation of refractory gold ores has been discussed by R. Carter and C. S. Samis⁹ who used, in their studies, an arsenopyrite flotation concentrate containing 1.63 oz. of gold per ton, 34.3 per cent iron, 33 per cent

sulphur, 17.1 per cent arsenic together with small amounts of antimony, lead, copper and zinc. The authors state that the main cause of low gold extraction from a calcined refractory ore is the occlusion of the gold by fused oxide. Further, the smaller the gold particles the more likely is this to happen and roasting conditions are therefore critical. The fusion of the oxides during roasting is probably due to the fact that the actual particle temperature is between 400° and 600° higher than the furnace temperature as measured. In addition, there is also the possible formation of an FeO, FeS eutectic, the melting point of which is some 450°C. less than the melting point of FeO.

The necessity for control of degree of oxidation is recognized in a patent claimed by J. B. McKay and J. V. Thompson¹⁰. The supply of oxygen for the roast is regulated so as to secure the reaction



A chromatographic method for the recovery of gold and silver values from cyanide leach solutions is claimed by the Merrill Co.¹¹ using a polyamine resin anion exchanger. The cyanide solutions are kept within the pH range 8.0-11.0 for the sorption, and regeneration is effected by treatment with alkali in the pH range 13.0-14.0.

Nickel, Copper and Cobalt

A method for the recovery of nickel and copper has been the subject of a British patent allowed to the International Nickel Co. of Canada¹². The sulphides are first of all concentrated and then flash smelted so as to obtain a matte rich in copper and nickel. The overlying slag, however, still contains an appreciable amount of

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copper and nickel, and molten drops of iron sulphide are allowed to fall through it, a process which results in the transfer of the two metals to the matte below. It is said that this method is especially suitable for the treatment of pyrrhotites which may readily be separated into two concentrates, one rich in pyrrhotite, and the other rich in nickel and copper sulphides.

A new chemical method has been reported¹³ for the treatment of oxide and sulphide ore concentrates, in place of the more usual smelting and refining techniques. The concentrate is subjected to an acid oxidation leach, followed by filtration to remove the gangue. Copper is removed by cementation, followed by reduction in ammoniacal solution. The cobalt and nickel are finally recovered together.

A patent covering the production of high purity nickel¹⁴ has been allowed to the Falconbridge Nickel Mines Ltd. A nickel sulphate-nickel chloride electrolyte is used, from which the iron, cobalt, copper, lead and arsenic are removed by oxidation with chlorine, followed by precipitation as hydroxides or, alternatively, the copper may be removed by cementation and the iron by aeration. At intervals, a portion of the electrolyte is withdrawn and electrolyzed to remove excess chlorine and sulphuric acid. This is done in order to maintain the chloride and sulphate ion concentrations at the optimum value for the deposition of nickel.

Another method for the recovery of nickel from nickel-copper sponge, obtained from a nickel-copper matte, has been claimed by B.M.S. Kalling *et al.*¹⁵ The nickel is leached out of the sponge with a liquor containing 25 g. per litre of sulphuric acid together with added sulphur dioxide. The leach liquor, which contains 50 g. per litre of nickel and 1.5 g. per litre of sulphuric acid, is oxidized by air and then fed, at 60°C., to the catholyte compartment which is separated from the anolyte compartment by a coarse diaphragm. The anolyte liquor is re-used for the leaching of fresh sponge. The current yield is between 70 and 90 per cent but this may be raised to between 95 and 100 per cent by the addition of sodium or ammonium sulphate.

It has been shown theoretically by P. B. Bryk¹⁶ that most types of sulphide copper concentrates can be smelted autogenously, provided that preheated air is used to compensate for any deficit in heat. A smelter operating on this basis has been put into operation in Finland, and, as might be expected, there is a considerable saving in fuel.

The Rare Earth Metals

Interest in the rare earth metals has increased with the advent of atomic piles since these metals are present in appreciable quantities in the fission fragments. Papers on the production of these metals have been published by workers in the Atomic Research Establishment at Harwell and in Institutes for Atomic Research in America. Gray¹⁷, in this country, has described the production of pure cerium metal by electrolytic and thermal reduction processes. Molten cerium rapidly attacks alumina, graphite, silica, magnesia and other materials likely to be used in

furnace construction but the molten halides are not so reactive. Accordingly, the electrolysis of the fused chloride was tried, but yielded a metal which was only 99.7 per cent pure. The purity was increased to 99.8 per cent by using a bath containing fused cerous fluoride 60.8 per cent, lithium fluoride 26.9 per cent and barium fluoride 12.3 per cent. Thermal reduction of the fluoride with lithium in a closed reactor yields a metal of 99.93 per cent purity containing up to 0.06 per cent molybdenum and 0.01 to 0.03 per cent iron. The reaction is initiated at 600° but slows down fairly rapidly.

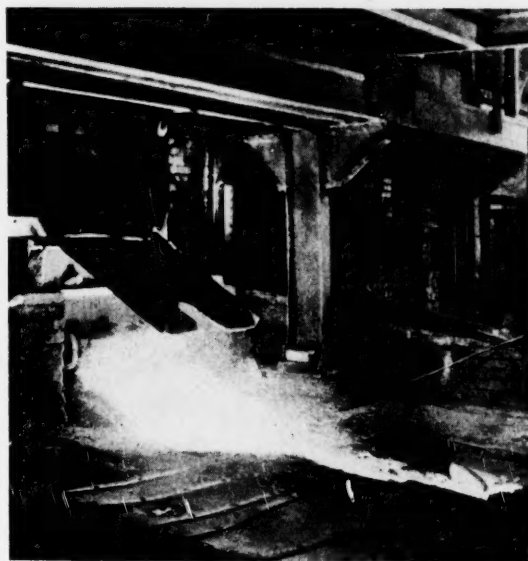
Thermal Reduction of Cerium

A thermal reduction method for cerium and other rare earth metals has been described by Spedding and co-workers¹⁸. Reduction was carried out in cylindrical bombs made from steel pipe having a refractory oxide liner. The charge consisted of the rare earth halide, a reductant, in this case calcium, and a "booster." The function of the booster was to produce an exothermic reaction and so raise the final temperature in order to obtain better separation of slag and metal. The booster reaction must not cause the introduction of impurities into the product and it must not take place pre-

maturely. This limits the choice and trials showed that iodine was particularly satisfactory for the purpose. The bomb was sealed off with a threaded cap and placed in a furnace at 650-750°C. When the bomb reached about 400°C. reaction commenced and was complete in a few seconds. The bomb was removed from the furnace and allowed to cool before being opened. An average yield of over 93 per cent was obtained, the metal produced containing 1.5 per cent calcium with 0.1-1 per cent magnesium. These may be removed by distillation when a pure clean metal is obtained.

Thallium

The recovery of thallium from smelter products has been described by J. D. Prater and co-workers, of the United States Bureau of Mines¹⁹. In America there are virtually no domestic supplies of thallium ore and the main output is supplied by the American Smelting and Refining Co. as a by-product of cadmium plant operations. It is also obtained as a by-product of lithopone manufacture, and from the flue dust of sulphuric acid works. The report, however, is mainly devoted to the problem of the recovery of the element from Cottrell precipitator dust from a lead smelter, and also from white arsenic. In the former case, thallium is leached out of the dust at 90°C. and the leach solution cooled to 25°C. when impure thallous chloride crystallizes. The mother liquor is recycled and the thallous chloride is then purified to yield a final product which is over 99 per cent pure. The over-all recovery is of the order of 85 per cent. In the case of the extraction from a white arsenic which contained 0.21 per cent of thallium, about 98 per cent of the arsenic was first of all volatilized, leaving 99 per cent of the total thallium in the residue. The thallium was then recovered from this residue by volatilization with sodium chloride at 800°C.



Tapping copper matte

(By courtesy of the Copper Development Association)

Tin

The recovery of tin from ores using a fluidized roasting technique has been the subject of a patent claimed by Wells, Thompson and Roberts²⁰. A bed of a tin-bearing sulphide ore is first formed in the volatilizing zone of a furnace and a stream of gas passed through at a rate sufficient to fluidize the ore. The temperature of the gas stream is such that the temperature of the bed is maintained at between 825 and 940°C. and the sulphur vapour content of the rising gas is kept at above 1 per cent by volume in order to volatilize the tin as SnS. Ore solids discharged from this bed form a second bed which is held at the roasting temperature, and through which oxygen-containing gas is passed at a fluidizing velocity. The oxygen lean gas which is obtained at the roasting temperature, is used in the volatilizing zone to control the temperature and the sulphur vapour pressure.

A further patent²¹ covers the recovery of tin in the form of tin sulphide from a low grade tin ore.

Titanium

Interest in the production of titanium continues to grow and this interest is reflected in the 1952 production figure for the United States alone which was of the order of 5,000 tons. The various methods of extraction of titanium were reviewed in *The Mining Journal* of July 18 and 25, 1952, but some modifications in technique have since been reported²². Fuller, Baker and Wartmann have described recent practice at the Bureau of Mines titanium plant at Boulder City, Nevada. The paper discusses the results of 105 production runs in which the titanium was produced in 200 lb. batches. The most important change in technique was the use of a sealed room having a controlled dry atmosphere. In this room, the reaction vessel was opened and the reaction products removed. This modification in

procedure meant that the uptake of water by the magnesium chloride was reduced to a minimum and this, in turn, had two important results. Firstly, successful purification by vacuum distillation was made possible. Secondly, a 1" shell of reaction material could be left on the walls of the reaction pot. This saved the labour of cleaning the pot out, and also reduced iron contamination. A further change, reported to give more satisfactory results, was the lowering of the temperature during reduction from 850° to 750°C.

A method for the production of titanium which avoids the presence of oxygen, nitrogen and hydrogen in the metal has been claimed by Dominion Magnesium Ltd.²³ The reduction of the oxide is carried out in two stages. Firstly, the titania is reduced to TiO or Ti₂O₃ with magnesium in an inert atmosphere at a temperature of between 550° and 565°C. Unchanged magnesium and magnesium oxide are then leached out with 5-10 per cent hydrochloric acid. The resulting oxide is then reduced with calcium in an inert atmosphere at a temperature of not more than 1,000°C. This method of production is said to yield a metal of 99.7 per cent purity.

The treatment of titaniferous magnetite from Iron Mountain, Wyoming has been described by A. E. Back *et al*.²⁴. The mineral analysis showed an iron content of between 49.3 and 52.3 per cent and a titania content of between 21.8 and 24.2 per cent together with small amounts of vanadium, aluminium, magnesium, silica, etc., the titanium being finely disseminated throughout the mass of the magnetite. The ore was roasted at 950°C. with 15 per cent sodium carbonate and the calcine leached with water. Ninety per cent of the vanadium was thus recovered as red cake containing 80 per cent vanadium pentoxide. The leached residue was then smelted with coke in a graphite

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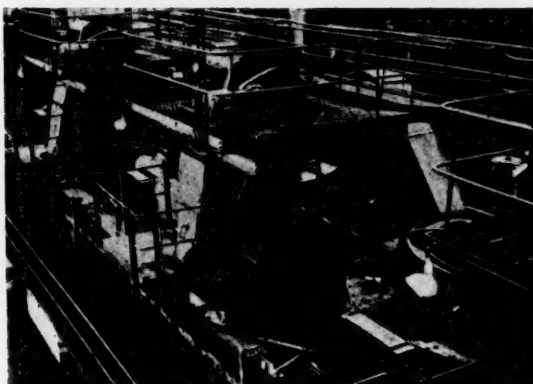
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lined arc furnace, the bulk of the titanium being recovered in the slag. The iron is recovered as pig iron containing less than 0.1 per cent of vanadium and titanium.

Uranium

A method for the treatment of phosphatic ores has been claimed by F. T. Seelye and T. A. Rafter²⁵. The ground or powdered ore is treated with 48 per cent hydrofluoric acid at just below 100°C. The temperature is maintained until the water has nearly all evaporated. Monazite so treated yields phosphoric acid and the uranium is rendered soluble. Thorium and the rare earths, on the other hand, form insoluble fluorides and separation of uranium is therefore readily achieved.

M. Larsson²⁶ has claimed a method for the extraction of uranium from bituminous shales and shale culm. The shale is suspended in a solution of an alkali carbonate or bicarbonate, and a current of air or oxygen containing gas blown through at a temperature of 25-33°C. The best results were obtained by taking half a kilogram of shale culm, ground to pass 0.15 mm. mesh, and suspending in 1 kilogram of a 10 per cent sodium carbonate solution. Oxygen was passed through the suspension, the temperature of which was maintained at 30°C. The temperature was then raised to the boiling point and the suspension kept at the boil, with agitation, for two hours. The solution, containing the extracted uranium, was then separated from the solid material, with a total recovery of 90 per cent.



Chilean mills for grinding of charge in production of zinc

(By courtesy of Imperial Smelting Corp.)

Zinc

The Sterling process, a new method of electric furnace smelting of zinc ores, has been described by E. C. Handwerk *et al*²⁶. The process, which is covered in patents²⁷ claimed by the New Jersey Zinc Co., produces zinc metal and pig iron. It was originally designed for the smelting of crude ore, containing 18-20 per cent zinc and an equal amount of iron, obtained from the company's Sterling Hill Mine, but it has since been used on high grade zinc concentrates.

Oxidic zinc ore, mixed with a carbonaceous reducing agent and iron oxide, is charged into an arc furnace. The furnace contains molten cast iron, on the surface of which floats a calcium silicate slag. The shape of the furnace, and position at which the charge is introduced, is so arranged that there is an exposed area of slag on which the arc may be struck. The charge, therefore, is heated both by radia-

tion from the arc, and also by heat transfer from the molten slag. Direct heating alone would produce a large quantity of nuclei by reduction of lime, magnesia and silica, on which zinc vapour would precipitate, with a consequent excessive production of blue powder. The reducing agent is added in sufficient amount to reduce all the zinc, and to effect partial reduction of the iron oxide.

This partial reduction must make available between 1.5 and 6 per cent of FeO for the molten slag. If the latter figure is exceeded, then there is insufficient carburization of the reduced iron and its melting point does not fall below 1,450°C. It is, in fact, necessary to operate between 1,100 and 1,400°C. to prevent excessive formation of blue powder. Carbon dioxide is an excellent oxidizer for zinc vapours, and in order to reduce effectively the amount formed during reduction, fuel oil or kerosene is dropped into the furnace. The cracking of the hydrocarbon yields carbon in a nascent form which is most effective in re-

ducing carbon dioxide. The slag produced contains only 0.1-0.8 per cent zinc. All of the gold and most of the silver is found in the cast iron, while the remaining silver, lead, and cadmium is carried over with the zinc vapour.

According to a patent claimed by G. J. J. Mould²⁸, in the electro-winning of zinc from its ores, higher current efficiencies may be obtained by adding a sodium soap to the electrolyte. Suitable soaps are those obtained from resin or beeswax, and they should be added in amount varying from $\frac{1}{2}$ lb. to 10 lb. per ton of zinc deposited.

Zirconium

M. E. Sibert and M. A. Steinberg²⁹ have reported on the development of a process for the production of zirconium by fused salt electrolysis. The method, which is not specially novel, obtains pure zirconium metal by the electrolysis of potassium zirconofluoride in fused sodium chloride in an inert atmosphere. Reminiscent of the Kroll process is the method claimed by C. H. Winter³⁰ for the production of zirconium or titanium. The metal halide is reduced to metal sponge by molten magnesium in an atmosphere of argon. Reduction takes place in a vortex formed on the surface of molten magnesium chloride which is being rotated with a stirrer. The sponge formed is continuously withdrawn from the bottom of the chamber and does not, therefore, come into contact with the walls, or accumulate on them. This does, in fact, represent an improvement over the Kroll process.

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Progress of Mining in the United States

By LEROY A. PALMER

FROM the standpoint of technology 1952 has been a fruitful year. All along the line from the search for new ore bodies to the delivery of the final product we find improvements in this or that. Not that all of these are newly born, they are, for the most part, the result of painstaking developments that had their inception in the laboratory or the drafting room and reached maturity only after patient labour and experimentation extending over months and, more frequently, years.

Exploration

In geophysical methods a new application is a magnetometer that is attached to one of the wings of the plane instead of being suspended at the end of a cable. With this mounting the magnetometer can be warmed up while the plane is being readied and can be put into use as soon as airborne while it eliminates inconveniences and hazards of a trailing cable.

Stimulated by the search for uranium ores sensitivity of such instruments as the scintilometer and the Geiger counter has been enhanced and one such instrument has been brought in by which the U_3O_8 content of an ore can be read directly from a dial and drill holes logged by use of a probe attachment.

Aerial surveys are finding a wider application than just geology or mapping in such fields as plant and operations layouts, measurement of dumps and stockpiles.

Drilling

The so-called "Swedish system" of drilling, light machines with tungsten-carbide bits, either carset of jack-bit, supported by air legs have gained in favour rapidly. One large mine after extensive tests has adopted this combination for all work except sinking. The air leg, which is equipped with an air fed cylinder, is clamped to the drill and the backward reaction of the drill is converted to a forward thrust. A leg weighs 35 to 50 lb which in connection with a light drill effects a very considerable weight saving over the conventional drifter and bar with corresponding time saving in setting up and tearing down. The mine cited above reports as high as 50 per cent increase in footage by such a change in equipment. A survey of 16 Canadian mines showed the great majority as favouring the Swedish system except under special individual conditions.

An effective machine for the control of dust so that dry drilling can be carried on without the attendant health hazard has become a reality. In one of these the drill steel is inserted through a hood which covers the hole and a line connected to a vacuum pump leads the drill cuttings to a separator in which the heavier particles are settled in

a cyclone and the finer caught in filter bags. A machine by an English manufacturer accomplishes the same purpose with a vacuum line operating through the drill and a duct through the drill steel so that cuttings are removed from the bottom of the hole as fast as they are formed. Vacuum is created by an "eductor" which takes high pressure air from the drill line and functions on the principle of a steam injector. Trapping of the dust is as described above.

Jet Piercing

Jet piercing has been improved by modification of the burner to give three jets so that one strikes directly downward from the centre and the other two at angles from opposite sides. So far the process has found its greatest application in making blast holes in the hard taconites of Minnesota and it is believed that this method will contribute materially to the economical working of these ores on which drilling costs have been a great, almost prohibitive, obstacle.

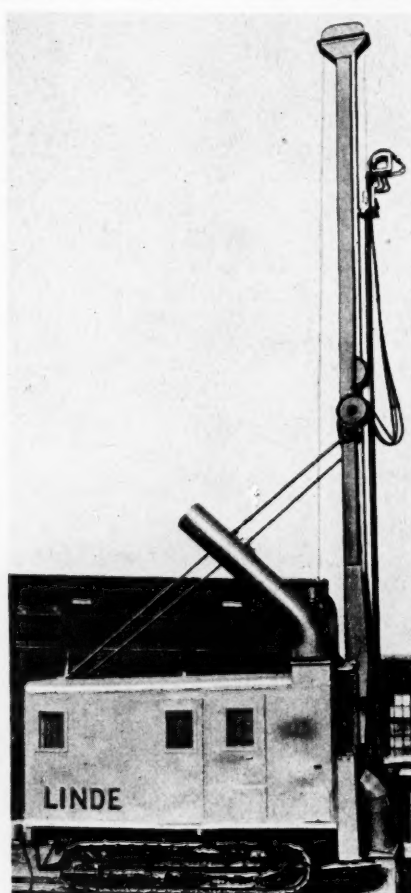
The essential feature of a jet piercer is a large blowpipe which is carried between two guides in a mast. A hollow kelly bar, such as used on rotary rigs in the oil fields, terminates in a 6 in. cylindrical burner. Inside the kelly are the fuel and oxygen lines with water circulating through the remaining space. The burner is surrounded by a cylindrical "hole sizer" which acts as a gauge and a guide in the hole as well as a water jacket. Fuel and water are fed under pressure and the kinetic impact of the oxygen against the liquid fuel atomizes the latter and the flaming gases are discharged from centre and sides of the burner against the rock. These jets emerge at an exceedingly high temperature, 4,300°F., with a velocity of 6,000 f.p.s., and the heat and velocity causes the rock to spall off in flakes and chips. The water which acts as a coolant for the burner is converted into steam and, mingled with the burned gases, rushes out of the hole at high velocity carrying the "cuttings" with it.

As may be expected, the holes are larger than the diameter of the burner and somewhat irregular in cross

section although fairly well controlled by the hole sizer. They are loaded with a can blasting agent and, as there is considerable void, the space is filled by a recently developed free running granular, waterproof explosive of sufficient density to sink to the bottom of a wet hole. An average speed of 15 ft. per hour was attained in piercing 20 holes in taconite with a 6½ in. burner which made a 9.3 in. hole.

Coal Mining

While strictly speaking it is boring rather than drilling, mention should be made of certain coal mining machines that involve a practice that has been under trial for many



Jet piercing rig showing blowpipe and mast guides

years and which appear to have been developed to a point where practical application is feasible. Cardox Corporation has made an "auger miner" which can be used in underground or strip mines and has been found especially adapted to narrow seams with bad roof conditions. It consists of a circular cutting head, 25 to 44 in. diameter, at the forward end of the auger, with steel bits spaced around the forward edge. Back of the cutting edge a conventional type coal bit and bursting cone reduces the size of the core to pieces that can be handled by the auger



Dust control by use of a drill hood which is referred to on the opposite page

which functions as a screw conveyor and as a guide to the cutting head and delivers the coal at the mouth of the hole to a collecting pan at the end of a shaking conveyor.

Guides allow control of the cutting head so that it can be kept in clean coal. While the machine is in scarcely more than the trial stage, holes in excess of 100 ft. have been bored. An auger with a 25 in. cutting head showed a production of 12.3 tons per man shift on a trial run, from which it was estimated that a 37 in. head would double that amount. The advantages of such a machine when worked from the outcrop are obvious; no trackage, timber, lighting, haulage, ventilation or blasting.

Carbide & Carbon Chemical Co. (Union Carbide & Carbon) has designed and built a coal miner on the same principle for use at one of its operations in West Virginia. This machine has four cutting heads which overlap and above and below is a bulldozer blade which breaks out the segments of coal left between the cutters, making a cut 38 in. x 116 in. As the coal is cut, paddles kick it back to a conveyor which discharges at the surface. It has excavated to 690 ft. without reaching capacity. Average progress is 18 to 20 in. per minute and production as high as 567 tons per eight hour shift has been attained with no men underground and a recovery of 65 per cent of the coal.

Mucking

Desirable as it is to improve drilling, little is gained thereby unless means are found by which removal of rock keeps pace with breaking. In some instances modifications of standard practice have accomplished this.

In sinking a 26 degree incline, 12 ft. x 8 ft., at U.S. Smelting Co.'s Ophir mine in Utah, dual mucking machines were used so that loading could be continuous instead of being held up while a skip was hoisted and dumped, then lowered. As a further time saver inner rails of the two skip tracks were set on the gauge of the jumbo so that the latter could be moved in and out by setting the loaders

to one side. The slope of 26 degrees is rather steep for mucking machines and some modification of the bucket design was necessary.

Slusher operation frequently involves the inconvenience of setting a double drum hoist in a drift or stope too narrow for such a use and this involves enlarging the opening, not only for the hoist itself but for the return rope as well. This brings about crowded quarters, troublesome fleet angles and other inconveniences. One mine operating a 72 in. scraper in a slusher drift solved the problem by using two single drum hoists tandem. The return drum is behind and slightly above the pull drum. The motor is behind the return drum and power is transmitted to both by chain drives. In this case a 7 ft. drift affords ample room for operation and accessibility.

Lorain has introduced a "scoop shovel" attachment which can be applied to its standard equipment. It consists of two telescoping booms with a $1\frac{1}{4}$ cu. yd. bucket to make it adapted to horizontal or near horizontal mucking. It can be operated in a 10 ft. 6 in. headroom and has been successfully used underground in salt, limestone, zinc-lead and iron ore.

The obvious equipment for mucking is the clamshell bucket. These have proved superior to hand methods but have shown a lack of efficiency due to the fact that they have used rope reeved buckets which depend for their biting power on the weight of the bucket when lifted. Bucyrus-Erie has developed a $\frac{1}{2}$ cu. yd. "hydro-mucker" in which closing is effected by two hydraulically actuated rams with a pressure of 3,500 lb. p.s.i. which effect closing of the bucket with a full load before it is lifted. The bucket is dumped to a two yard mucking tray at the bottom of the shaft and when this is full the hoist line is transferred from the bucket to the tray, the latter is hoisted and dumped to a car on a cage in the lowest shaft set. The method was worked out at the Mather B shaft of the Cleveland Cliffs Iron Co. where it was estimated that it showed a 35 per cent improvement over hand mucking in a 15 ft. x 20 ft. shaft.



The Lorain scoop shovel operating underground in a Detroit salt mine

Some Interesting Mining Methods

Among interesting innovations of the past year is an operation by the Du Pont interests for recovery of ilmenite and zircon from sands of an ancient beach near Starke, Florida by dredging. The sands lie at depths of 20 to 70 ft. with frequent layers of hard pan, which are broken ahead of the dredge by light blasting. The deposit is low grade, TiO_2 content averaging only 1.3 per cent. Excavation is by a 20 in. pump mounted on a barge 32 ft. x 104 ft. which floats in a pond a half mile long excavated for the purpose. Sands are discharged to the washing plant on three barges which carry conditioner plant, rougher plant and finisher plant. Separation is by Humphrey spirals, 1,100 in all, and it is the combination of this machine with the dredging

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that has made it possible to work this low grade deposit.

A somewhat comparable operation has been initiated by Freeport Sulphur Co. at its Bay Ste. Elaine deposit in Louisiana which is situated underneath a salt marsh. Under similar conditions the marsh land has been built up by hydraulic fill but this was decided against as the indications at Bay Ste. Elaine are that the size of the deposit would not justify the capital expense. Consequently, an "amphibious operation" was adopted and the plant built on barges, to which supplies were delivered by barges plying on canals instead of trucks running on roads. The "mining plant," installed on a barge 40 ft. x 200 ft., supplies electric power, compressed air, steam and hot water. Water at 325° F. is injected into wells driven to the sulphur strata and the sulphur so melted is pumped to a 1,000 ton insulated tank barge which delivers it still molten to the storage bins at Port Sulphur, 75 miles distant. A notable departure from common practice in application of the Frasch process is that sea water is used throughout, made necessary by the fact that the nearest fresh water supply is 35 miles distant. To resist the deleterious effect of the salt water corrosion resistant alloys are used in the heat exchangers and surface pipes have cement linings. The plant is designed to handle 100,000 tons per year.

A Block Caving Problem

At Miami Copper Co's mine in Arizona, there has been mined 125,000,000 tons by using a standard block caving system in which the ore, broken by its own weight, settles and works its way by gravity to the haulage level. In the operation at Miami, pillars 125 ft. high were carried between the undercut and haulage levels, but as work progressed downward, it was found that the ore bottomed too close to the haulage level to permit the use of a pillar of that height, and the only way to adapt a pillar of less height to a gravity system would be to drive a new set of drifts and raises at a lower level which would not be economical. To allow recovery of the ore without this extra development work slushers were installed in the grizzly drifts, and conveyor drifts, installed with belt conveyors, were driven 18 ft. below and at right angles to the grizzly drifts and connected to the latter by raises. In operation the ore passes from the control raises to the grizzly (now slusher) drifts and is dragged to the raises to the conveyor level; thence through the conveyor level to the main haulage. As ground control is a major problem at Miami and it is necessary that all drifts involved in handling the ore be kept open, semi-circular steel supports with heavy timber lagging have been installed in slusher, conveyor and haulage drifts.

Stope filling with mill tailings is nothing new but in previous practice it has been customary to classify the tailings and use only the sands for filling so as to allow the water to drain freely from the fill. Dayrock mine in the Coeur-d'Alene district in Idaho has modified this system to use one in which the tailings are agitated, settled and then discharged to the mine, the only classification being

the small amount of slime that overflows the agitator. The settled tailings, containing 69 per cent solids, flow to the mine and into the stope by gravity. An essential feature of the system is to make provision that the water drains as fast as the fill is poured so that it does not accumulate hydrostatic pressure. Changing from waste to tailing enabled Dayrock to effect economies in mining other than those directly appertaining to the filling method.

Haulage—Transportation

To counter an increased haulage burden frequent resort has been had to railroad practice and block signals have been standard equipment for years and now the miner is taking another leaf from the railwayman's book. At its mines at Birmingham, Alabama, Tennessee Coal & Iron Co. has installed an FM communication system as supplemental to the block signals on its haulage system. Thus communication is established between the dispatcher, locomotives and other points on the haulage, and locomotive operators can talk with their crews and operators of other locomotives. Power is taken from the trolley wire.

This system of instantaneous communication has affected improvement in efficiency and safety and a marked time saving in handling ore. At Kennecott's open pit mine at Santa Rita, New Mexico, a similar FM system has been installed by which trucks, locomotives and a mobile crane are directed from a control tower.

American Mine Door Co. has come up with a novel "car transfer" by which, while a train is being loaded in a drift, an empty car is kept in position beside the track so as to be advanced to the loading position without switching as the loaded car is withdrawn.

In transportation there is a broadening of the use of belt conveyors and a continued increase in the size and capacity of trucks.

In uranium mining in the Colorado Plateau region it is necessary to follow the ore bodies which are of varying thickness and with changing dips and "rolls," a condition that makes track haulage wellnigh an impossibility. To meet this situation a "shuttle cart" has been devised which has been satisfactory both underground and on the surface. It is a one ton truck with three rubber tyred wheels by which it can be turned in its own length. Power is either by a Diesel engine with exhaust conditioner for underground work or electric transmitted by trailing cable from a generating unit on the surface. It is used either for gathering or in the adit to the surface. Being able to turn in its own length and operate on a 40 per cent grade it has been satisfactory in solving many of the haulage problems in these irregular deposits.

Typical of development in off the highway trucks is a 50 ton Euclid brought out during 1952. This truck has a payload capacity of 50 tons, equal to that of a railway gondola of not so many years ago, weight empty is 52 tons, power is from two 300 h.p. Diesel engines and dump is hydraulically operated. It is carried on ten 18:33 x 33, 32 ply rock lug tyres. This truck is rear dump but side dump



The Bucyrus-Erie ram-operated clamshell $\frac{1}{2}$ cu. yd. hydro-mucker. (See also page 71.)



Conquest of hunger

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bodies of capacities in excess of 30 tons that can be mounted on standard chassis are now in use. These are of both tipping and "turnover design." Meanwhile "Tournarocker" has been enlarged to 50 ton capacity with a Tournapull that can turn the unit in less than its own length and larger units involving Diesel electric drive are promised.



The Euclid Model LLD of 50 tons capacity

A car shaker to facilitate unloading railroad gondolas is suspended from a double A frame which spans the track over the bin or stockpile. When a car is spotted the shaker is lowered and grips both sides and a motor eccentrically connected to the shaker causes the car to vibrate in excess of 1,000 strokes per minute. It is particularly adapted to unloading fine material such as concentrates and coal screenings and is effective on wet and frozen material.

An innovation in the field of conveyor systems is made of aluminium and employs neither belt nor pulleys. Material is carried in aluminium pans 6 ft. long which ride between two rails and are moved forward by the rapid vibration of the rails. The system is light and is built in sections so that it can be knocked down and re-erected with a minimum of labour. It has found use in place of shuttle cars to collect coal from the rooms and deliver it to the main entry belt.

An Ambitious Conveyor System

By far the most ambitious conveyor system yet conceived is that described in considerable detail in *The Mining Journal* of November 7, 1952. So far it is only a plan but it has been carefully designed by competent engineers and while revolutionary in its conception does not appear any more visionary than did, in their time, many of the things that are now commonplace. Briefly, it is a series of conveyors, 130 miles long, to serve the heavy industries, largely blast furnaces and steel mills, of Eastern Ohio by transporting ore and limestone southerly from Great Lakes ports and coal northerly to them. There will be 103 miles of main line and 27 miles of feeder line. The entire system will be housed and it is so designed that a single belt will carry loads in both directions.

Metallurgy—Ore Dressing

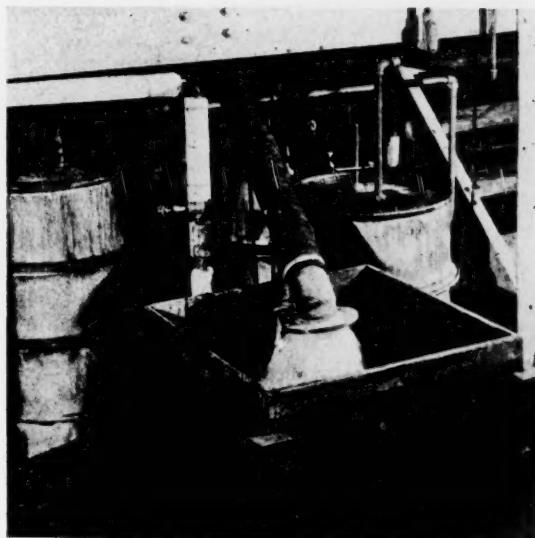
Probably the greatest achievement in this line is that Chemical Construction Co., "Chemico," a subsidiary of American Cyanamid, has, as the fruit of seven years of research, developed a process for the production of pure metallic powder in one step from either crude ore, concentrate or scrap. So far work has been principally on copper, cobalt and nickel, which have been produced as metals, but manganese has also been produced as an oxide. Very briefly the process involves leaching (either acid or

basic) in an autoclave, filtering, reduction of filtrate by hydrogen gas in an autoclave, drying. Careful control during the reduction process allows precipitation of the metals in practically pure state (copper 99.9 per cent). Pressure and temperature are of the utmost importance and the process must be "tailored" to the individual ore.

Howe Sound Co. is operating a Chemico plant at Garfield, Utah, for recovery of cobalt; Sherritt-Gordon, which contributed effectively to the research, is building a \$17,000,000 nickel plant at Edmonton, Alberta and National Lead is spending \$5,000,000 at Fredericktown, Missouri for copper, nickel and cobalt.

In the light of such information as is available possibilities of the process are startling. General William N. Porter, president of Chemico, made the statement that savings in capital and operating costs would be such that "in converting from the old smelting and refining methods to these newly developed processes it is expected that costs of scrapping existing facilities in many cases can be made up in about three years from operating savings." Instead of a large, centrally located plant representing a great investment, the powder process visualizes smaller plants at individual mines at which ore in the stope would be converted to marketable metal within a matter of hours, with no shipment to smelter and refinery, and no delays in settlement. Such reduced operating costs will make it feasible to mine and treat ores now considered submarginal.

At Nichols, Florida, Virginia-Carolina Chemical Co. is recovering uranium from phosphate rock as a by-product of chemical phosphate manufacture and at Mulbery, Inter-



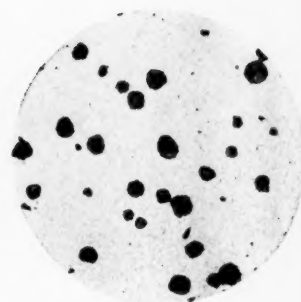
Water and powdered copper discharging from washing tank to box filter in "Chemico" process

national Minerals & Chemicals Corporation has a process for dry beneficiation (no reagents or water) of potash and phosphate ores. M. A. Hanna Co., after extensive research in co-operation with the U.S. Bureau of Mines, has worked out a system for its large deposit of siliceous nickel ore in Oregon.

On the Mesabi Range, Reserve Mining Co. is at last preparing to produce taconite concentrate on a large scale in a plant built 30 years ago by Mesabi Iron Co. for research on these ores. Very briefly the process involves crushing, grinding and classification, magnetic roughing, further grinding of the rougher product, concentration, magnetic separation, filtering and agglomeration.

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Developments in Production of Alloys

By A. E. WILLIAMS, Ph.D., F.C.S.

WHILE the demand for certain metals, such as nickel and molybdenum, still exceeds the supply, these conditions tend to give an impetus to the search for alternative elements for use in the production of alloys. As a consequence the research programmes of the organizations concerned with alloys become fuller than ever.

Development in Cast Iron

In the cast iron field, the most notable development in technique is the work achieved in establishing the properties of the new nodular materials. Nodular cast iron is produced on a wide industrial scale in the U.S.A. and the magnesium process is the one preferred. This dovetails into the cerium process, particularly in Britain, because certain subversive elements present in British pig irons and other raw materials inhibit the effect of magnesium and can only be neutralized by the use of very low proportions of cerium. During 1952 work on the production of nodular cast irons has, therefore, been concerned with the effect of elements which prevent magnesium from having the desired nodulizing effect. It has been shown that titanium, lead, antimony, aluminium and bismuth, and in some cases also copper can partly or completely prevent the formation of nodular graphite structures. Further, it has been shown that the subversive effects of these elements can be entirely offset by the addition of approximately 0.005 per cent cerium. A comprehensive report on this work was published in the April, 1952, issue of the *Journal of Research and Development* of the British Cast Iron Research Association. The study of the effects of other interfering elements and the neutralization of the effects of subversive elements by other rare earths is in hand.

Alloy Steels

Investigations on carbide formation in high-speed steels have been made by H. J. Goldschmidt (*Journal Iron & Steel Inst.*, March, 1952) wherein an X-ray examination carried out on filings and electrolytic carbide extracts of high-speed 18-4-1 steels showed that, apart from the austenite-martensite transformation, a variety of changes in carbide structure can occur on hardening and tempering and with varying alloy content. These changes are certain to have a considerable influence on properties. The carbide ϵ ($\text{Fe}_4\text{W}_2\text{C}/\text{Fe}_3\text{W}_3\text{C}$) is always predominant, and frequently is the only carbide present, but additional compounds are formed. Internal changes in lattice parameter occur within the ϵ carbide—owing to differences in alloy content of the carbide—as well as in states of strain and sub-division. The carbide is very hard but, it is suggested, is inherently hardenable, and in this feature is seen a

practical application of the carbide as raw material for powder metallurgical uses. The partition of alloying elements between matrix and carbide varies with heat-treatment; cobalt, for example, is observed initially, after hardening and short tempering, to reside entirely in austenite and martensite; but, on prolonged tempering, migrates partly into the carbide.

To study the complex diffusion processes involved in the approach to equilibrium of a Cr 24 per cent, Ni 5, Mo. 2.5 and C 0.45 per cent, valve steel at temperatures up to $1,150^\circ\text{C}$., the microstructural changes produced by heat-treatment at several temperatures have been studied by B. Cina (*Journal Iron & Steel Inst.*, July, 1952). The study being carried out at room temperature by optical microscopy, X-ray diffraction, and hardness determinations, and a correlation found between the results obtained by the three methods. Metallurgical observations relating to the

occurrence of sigma-phase in ferrite-free 25 per cent Cr, 20 per cent Ni bar steels have been recorded by J. I. Morley and H. W. Kirkby (*Journal Iron & Steel Inst.*, October, 1952). Particular attention is paid to the effect of variable grain size, arising from different annealing temperatures, on the distribution of the constituents, on their rates of precipitation, and on the tensile and impact properties of the steels after the complete precipitation of the carbide and sigma-phases. As much as 10-15 per cent of carbide and sigma-phases may be present in the fine-grained steels without serious loss of tensile ductility; but moderate grain coarsening, such as might arise from a 100°C difference

in the prior-annealing temperature, will result in the almost complete loss of tensile ductility and impact resistance in the presence of the same amount of sigma.



Installation of semi-continuous nitriding furnaces for aero-engine cylinders

(By courtesy of Nitralloy Ltd.)

Nitriding Process

There has been considerable expansion in the range of alloy steels suitable for treatment by nitriding. The original Al-Cr steels of Fry still continue to be the most widely used, since they give the maximum hardness after nitriding together with good physical properties in the core. These are the Nitralloy steels containing about 1.1 per cent Al, and 1.6 per cent Cr, with a range of carbon from 0.2-0.5 per cent to give various mechanical properties in the core steel and tensile strengths of from 35 to 98 tons. In order to meet specific requirements for higher fatigue resistance and toughness in the core steel, many other steels have been evolved for use with the nitriding process; while on the other hand, nitriding has been applied, with additional refinements, to existing alloy steels, such as the austenitic steels. Thus, high-chromium-molybdenum steels are now widely used in the nitrided condition. The search for a steel combining corrosion resistance with wear resistance has led to considerable attention being paid to the nitrid-

ing of stainless steels. These always contain chromium, together with molybdenum or tungsten in some cases; they respond to nitriding when the passive surface film has been removed. Since the chromium in solid solution in most stainless steels is precipitated as a nitride by nitriding, the corrosion resistance of nitrided stainless steel is less than that of un-nitrided stainless steel, although it is better than that of other nitrided steels.

Experiments in America

Work has been done on this question in the U.S.A., in particular on the 12 per cent Cr material. The hardness obtained is about 820 Vickers, but the case is relatively shallow, being about 0.01 in. With 18-8 stainless steel the hardness is about 800, with an effective depth of 0.005 in. The advantages of nitrided stainless steel for such parts as valves, pump parts, etc., are obvious, but there are limitations to its wider adoption. The most recent development in the field of nitriding steels is that of the graphitic Nitralloy steels, which are of such composition that they can be partially graphitized by a simple heat treatment, are easy to machine and may be nitrided to possess the properties of the standard nitrided Nitralloy steels. Moreover, the graphite particles serve as a lubricant or, in case they become dislodged, the microscopic pits serve to retain oil. These steels contain aluminium, chromium and molybdenum, with an adjustment of the silicon and aluminium contents (the graphitizing elements) against the chromium and manganese (the carbide stabilizers) to give the desired microstructure in the heat-treated product, while giving satisfactory nitriding characteristics.

Creep-Resistant Alloys

Creep is an aspect of the behaviour of metals which has assumed special importance in relation to engineering developments in the production of engines of high power and efficiency, recent examples of which are the jet engine and gas turbine. In these units the metallic alloys are subjected to stress continuously for long periods of time and at high temperatures. This subject has been reviewed by A. H. Sully (*Murex Review*, Vol. 1, No. 9) who records that the problem which the metallurgist has to face is that of adjusting the composition of the basic metals and alloys to confer resistance to slow deformation without sacrifice of the other equally essential properties. In most of the important commercially utilized creep-resistant alloys of all types this improvement is secured by precipitation hardening effects, and it is often found that some additions are much more effective than others in conferring resistance to creep deformation.

The hardening constituents, which may produce hardening effects and enhanced creep resistance, are diverse. In some cases they are genuine intermetallic phases, in others they are intermetallic compounds such as carbides or nitrides. While the composition of modern creep-resistant alloys are often extremely complex, in all cases the precipitating constituents confer resistance to deformation by interfering with the processes by which deformation

normally occurs in metals. They precipitate in crystal boundaries and so greatly increase the intergranular viscosity and hinder the relative movement of adjacent crystals. They precipitate inside the crystal in the form of very fine particles which increase the resistance to shear displacement along slip planes. In some metals this effect can be emphasized by carrying out a mechanical working process on the metal while it is at a temperature at which precipitation occurs; so that the precipitation is caused to occur preferentially along slip planes and the resistance to subsequent deformation is considerably enhanced.

Alloys in the 650°-900°C. Range

Where the temperatures to be encountered by the metal in service lie between 650° and 900°C., the alloys which are in use fall into three main groups. The first of these is the nickel-chromium alloys which are essentially nickel-base alloys to which chromium is added to confer resistance to oxidation and other elements to impart creep resistance. They commonly contain up to about 25 per cent Cr with up to 20 per cent cobalt; while the precipitation hardening additions are most commonly titanium (1.5-3.0 per cent) and aluminium (0.5-1.5 per cent). The second group covers austenitic steels and although the steels from which these were developed were essentially iron base materials, some of this group are now so highly alloyed that iron forms less than 50 per cent of the alloy. The common major additions are chromium (up to 25 per cent), nickel (up to 30 per cent), and cobalt (up to 20 per cent). Minor additions may be molybdenum, tungsten or niobium, all usually less than 5 per cent, and carbon up to 0.5 per cent. Hardening and creep resistance are due to the precipitation of complex carbides and intermetallic phases. The third group comprises cobalt-base alloys, which are relative newcomers to the high temperature field and usually contain up to 30 per cent chromium to confer oxidation resistance, and nickel, molybdenum, or tungsten and carbon. They are not readily forgeable and are most commonly used in the cast or the cast and heat-treated condition.

Ni-Al Bronzes

Much interest is being shown in wrought complex aluminium bronzes containing large amounts of nickel and iron, and a paper on this subject has been presented by M. Cook, W. P. Fentiman and E. Davis (*Jour. Inst. Metals*, April, 1952) which gives information on structure, hardness and tensile properties of alloys within the ranges Al 8-12, Ni 4-6, Fe 4-6 per cent. For the preliminary investigations ingots weighing 10 lb. each were cast and hot-rolled into strip 0.30 and 0.10 in. thick. Investigations were made into the structure of the alloys under equilibrium conditions between 1,000° and 500°C., and into the structural changes which occur when the alloys are brought into equilibrium at 1,000°C. and then tempered between 300° and 900°C. for periods up to 256 hours. The mechanical properties of representative alloys were also



Impeller casting in Admiralty gun-metal; weight 4,165 lb.
(By courtesy of the Phosphor Bronze Co. Ltd.)

studied, both as quenched after bringing into equilibrium at various temperatures, and after different tempering treatments following quenching from 1,000°C. As a result of the preliminary studies, six alloys were selected for processing on a larger scale, and observations on the effects of hot- and cold-rolling and subsequent treatments were made; while the properties of extruded alloys were investigated. In examining the mechanical properties, the range of composition selected was nickel and iron 5-6 per cent each, with 8.5-10.5 per cent aluminium. The investigation was confined to consideration of the structural features and mechanical properties of such materials in the conditions obtained by the normal industrial operations of hot- and cold-rolling, etc. Properties of five alloys in the foregoing range were determined in the quenched, quenched-and-tempered, hot-rolled, and hot-rolled and annealed conditions. In general, optimum properties were obtained in the alloy containing Al 10, Ni 5, Fe 5 per cent, balance being copper, for which a large amount of data is recorded.

Nickel Silver

The composition, properties and uses of modern nickel silver casting alloys is discussed by J. S. Vanick (*Nickel Bulletin*, January, 1952), the nickel silvers containing copper and zinc, with nickel carrying between 6 and 30 per cent, with or without other elements to confer special properties. Compositions covered by A.S.T.M. specification B 149-49 are given and compositions of cast nickel silvers used for specific applications are tabulated. The individual effects of tin as a strengthening and hardening ingredient, of lead to confer machinability, and zinc, for its deoxidizing influence, are discussed. It is shown that nickel has a progressively beneficial influence on resistance to corrosion, and a 20 per cent alloy has good resistance to sea water, fresh water and indoor atmospheric attack. The attractive colour of nickel silvers has led to increasingly wide use and a wide range of castings are now made in different grades of the alloys, both of the straight Ni-Cu-Zn type, and of alloys in which small amounts of tin, lead, iron or manganese are present in differing combinations.

Foundry Practice

In connection with foundry practice and composition of the charges, the following are given as preferred maximum impurities in nickel silver alloys: iron 0.5, manganese 0.25, silicon 0.05, sulphur 0.035, carbon 0.1, per cent. Particular attention is directed to the harmful effect of silicon. Certain of the nickel-modified 60-40 type brasses resemble the manganese bronzes in the high strength properties which they develop in the cast or forged condition. For example, a 15 per cent nickel alloy of this class shows tensile

strengths up to 85,000 lb./sq. in., with 20 per cent elongation. An alloy in this category which contains 12-15 per cent nickel is used for propellers.

A further group of nickel silvers is the die-cast or forged type, and these high-strength materials contain about equal parts of copper and zinc, with some 6, 10 or 15 per cent of nickel. Good corrosion resistance is a property which widens the range of application. An alloy of white colour, characterized by high hardness and wear resistance, is much used in hardware, sanitary equipment and other fixtures. Typical uses of nickel silver casting alloys include ornamental plaques, internal structural parts in buildings, marine fittings, and food-handling equipment.

Die Casting

Die casting is the process of producing accurately dimensioned parts by forcing molten metal under mechanical pressure into metal dies or moulds. In this sphere zinc alloys are becoming increasingly popular, a typical alloy containing 4 per cent aluminium and 1 per cent copper. The widespread adoption of zinc alloy die casting for the production of automobile components has now made this industry by far the largest consumer of zinc alloy die castings, taking over half the production in the whole industry, both in Great Britain and the U.S.A. Zinc alloys have become the most popular metal for die casting as their low melting points do not damage the dies and injection cylinders. The effect of cadmium and tin on zinc-aluminium alloys has been studied by Japanese investigators (*U.S.A. Chem. Abs.*, February 25, 1952, 46) and in examining the intercrystalline corrosion of zinc alloys which is promoted by the presence of cadmium and tin, the investigators conclude that such corrosion may be prevented by adding six times as much magnesium as cadmium and ten times as much magnesium as tin. Annealing at 150°C. for 24 hours is said to promote intercrystalline corrosion. It is found that the presence of even slightly more than 0.003 per cent lead in zinc die casting alloys causes brittleness on ageing, while magnesium is of value in protecting alloys from ageing.

Zinc alloy die cast munition components play a prominent part in this sphere, and enormous quantities of grenade and fuse parts are being made in this way both in Britain and in the U.S.A. Nose pieces for A.A. shells have been produced on 40-impression dies, trimmed in a single operation on a power press. During 1952 a new British cold chamber die casting machine intended for making large castings in the higher melting point alloys has been introduced. It can cast 8½ lb. of metal in one shot and it is electrically-controlled so that operations always occur in a predetermined order.

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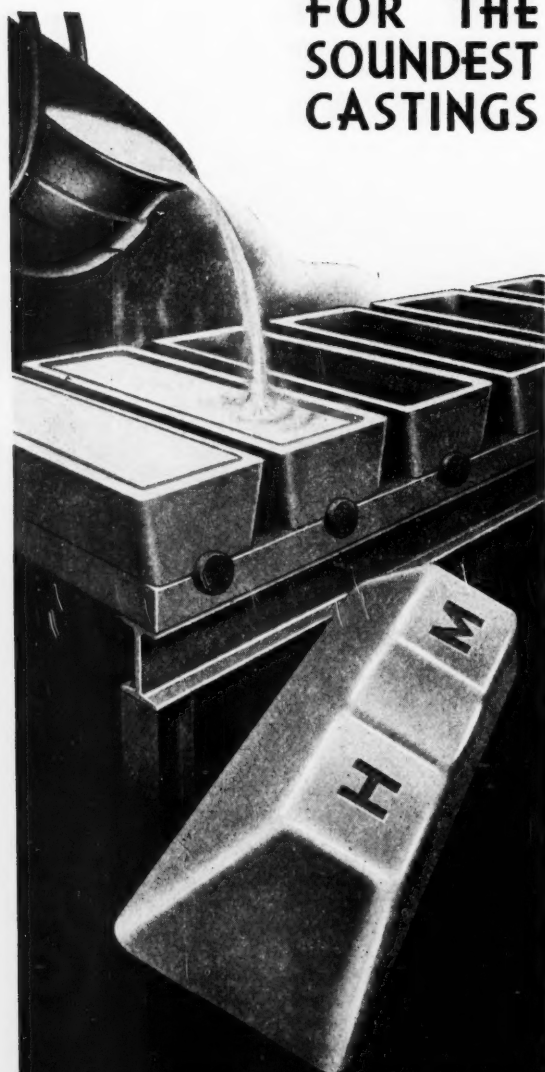
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Powder Metallurgy

By A. E. WILLIAMS, Ph.D., F.C.S.

WHILE the potentialities of powder metallurgy techniques as a method of production are becoming more widely known, there are still many organizations in the metal-working spheres where this branch of metallurgy is not being used to its fullest extent. In some cases this is due to lack of co-operation between designers of components and production staffs. Within the Defence sections of the Ministry of Supply this deficiency has been recognized and a special committee has been formed to consider methods for increasing the applications of powder metallurgy. Steps have also been taken to outline a series of standards both for metal powders and the products resulting therefrom.

On December 11, 1952 a conference was held at the British Standards Institution to consider the feasibility of preparing British Standards for the materials used and produced in this field. As a result, a group has been formed to deal with the formulation of standard testing methods and to prepare standard definitions for metal powders. In the U.S.A., the 1953 Metal Powder Show and Ninth Annual Meeting sponsored by the Metal Powder Association is to be held in Cleveland. Both in the U.S.A. and Britain, powder metallurgy techniques are being increasingly applied to the production of self-lubricating bearings, cutting tools, refractory components, and filters; while experimental work shows that these methods will probably be applied in the near future to the manufacture of parts highly resistant to heat for use in turbines, jet engines, etc.

Powders

Now that pre-alloyed stainless steel powder is readily available it makes possible the combination of the corrosion-resistance of stainless steels with the special properties and economic advantages of the powder metallurgy process. Filters made from molybdenum containing nickel-chromium steel powder have already solved some problems in the food, petroleum and chemical industries; and for use in conditions of combined high-temperature and corrosion attack, filter units are being made in special nickel and cobalt-base alloys.

In Germany a process has been protected for the production of a finely divided pyrophoric iron powder from ferromagnetic materials by vapour condensation in a vacuum. When this powder is used for the manufacture of permanent magnets, a proportion of chromium powder is also applied to act as a protective layer on the iron powder. The vapour condensed powder may be too finely divided to create a maximum coercive force, but the necessary grain size may be obtained by several methods of manipulation, such as maintaining the condensation temperature not above 350°C., or heating to this temperature either before or after compacting.

According to Brit. Pat. 659,998, sintered metal mixtures for anisotropic magnets contain iron, nickel, aluminium, at least 14 per cent cobalt, and optionally up to 10 per cent of other elements. A preferred composition is given as cobalt 14-30, nickel 7-30, aluminium 5-11, copper 0-10, titanium 0-5, silicon 0-5, zirconium 0-5 per cent, the balance being iron. A pressed body of the powdered material is sintered in a non-oxidizing atmosphere while protected from direct access of the atmosphere by a porous mass containing (1) a powdered or granulated alloy of titanium and/or other elements having a high affinity for carbon and nitrogen; and (2) aluminium and/or other

metals which are readily oxidizable at high temperatures. The protective alloy may be mixed with an inert refractory, for example, Al_2O_3 , and the refractory may be interposed between the powder to be sintered and the protective mass.

A method for the production of cores of loading coils, etc., is described in Brit. Pat. 658,241, in which recrystallized mixed sulphates of ferromagnetic metals are converted to mixed oxides by rapid heating. The oxides are reduced by heating in a reducing gas to produce a friable alloy. The powder obtained from this alloy has high initial permeability, with low coercive force and residual induction, and a typical composition of the alloy is nickel 45, iron 31, and cobalt 24 per cent.

An improved process for the production of metallic titanium has been evolved by the Titan Co., Inc., wherein titanium tetrachloride is reduced by electrolytic means to the trichloride or dichloride in a molten $NaCl-SrCl_2$ bath, the process then being modified for reduction to the metallic titanium having a purity of around 99.6 per cent. Titanium dichloride in the electrolyte produces a coarsely grained deposit very suitable for remelting to pure metal, while the trichloride gives more finely powdered products which have a tendency to absorb impurities.

The British Thomson-Houston Co. has developed a method for adding lubricant to powdered products, in which carbide powder mixtures are waxed by atomizing a molten pressing lubricant with CO_2 in the presence of a controlled powder supply. Automatic control of the process is ensured by the weight of the lubricant and powder, and these then pass into a hammer mill and finally into a container, while the CO_2 atmosphere is maintained throughout the process. The rate of powder flow from mill to container is about 25 kg./min., which is up to 15 times faster than methods hitherto in use.

Sintering

In progress reported in the production of sintered high-density tungsten and tungsten alloys by the Callite Tungsten Corp., densities up to 99.5 per cent of theoretical were obtained in alloys containing 10 per cent copper-nickel or the same proportions of cobalt-silver. Such high densities are more difficult to achieve when the alloy contents are lower, which is very desirable for some applications; and in this case purity and particle-size distribution has to be carefully controlled.

Non-volatile residue in tungsten powder is determined by oxidizing the sample to WO_3 and passing hydrochloric acid gas over this. The oxide is converted into volatile tungsten oxychloride which is carried off by the acid gas, leaving a residue of non-volatile matter. In a good grade of powder the amount should be less than 0.02 per cent, while in an inferior grade it may be as high as 0.5 per cent; the residue consisting mainly of alkali, silica and alumina. Such impurities hinder or prevent true alloy formation.

In mixing the various metal powders use is made of a ball mill, in which a proportion of carbon tetrachloride is added to the metal powders; mixing being carried on for about 10 hours. As a lubricant it is common to add a small percentage of paraffin and this facilitates pressing at 15 to 20 tons/sq. in. Sintering for the 10 per cent alloy containing composition takes place at 1,350°-1,400°C. and for the 99.5 per cent tungsten material between 1,500° and 1,650°C. In cases where the products cannot be machined

in the final sintered condition, they may be pre-sintered at a temperature between 800° and 900°C., and in this condition the products may be easily machined.

In a process of the Badische Anilin- und Soda-Fabrik (Brit. Pat. 672,354), powders having good sintering properties are manufactured by precipitating hydroxides of metals from solution of their salts by means of ammonia or ammonium carbonate, and subsequently reducing the hydroxides, preferably in hydrogen, at an elevated temperature, and when necessary, under pressure. In the production of powders of copper, nickel, cobalt and zinc it is preferable to re-dissolve the first precipitate with excess ammonia, filter off solid impurities, and again precipitate by elimination of ammonia.

The same company has also made improvements in the production of porous metallic components (Brit. Pat. 668,147) wherein the porosity of shaped articles made by sintering magnetic metal or metallic oxide powders is increased by subjecting the powder to a magnetic field before or during sintering. The pore volume of a sintered accumulator plate of carbonyl-nickel powder can thus be increased from 80 to 84 per cent, saving 20 per cent nickel.

Sintered Strip

In the sphere of sintered semi-finished products, the Sundwiger Messingwerk K.G., Germany, reports that it is in production for the following sintered materials: (1) Strip made of electrolytic copper, phosphor-bronze, cupro-nickel, either dense or porous; graphited phosphor-bronze with or without a steel backing; red brass; (2) Clad materials, for example, red brass or lead-bronze on steel; phosphor-bronze on silver; friction materials or hard facing on steel; and asbestos on iron or bronze. Following upon the very recent development of the manufacture of strip material by powder metallurgy methods, as reported in last year's *Annual Review*, this German company is now producing strip with a maximum width of 300 mm. (about 8 in.) and in various thicknesses. The technique adopted is one of rolling and sintering the required powder mixes, and the materials mentioned under (1) can be manufactured to any required length; but those under (2) are generally made in lengths up to 2 metres only.

Rolling Powder Compositions

It is found that special powder compositions can be successfully rolled, as, for example, a mixture of 70 iron with silicon for corrosion resistance, or 70 iron with 30 aluminium for resistance heating elements. In Brit. Pat. 683,020 a method is described for producing porous aluminium strip for making electrodes. This is done by sintering a thin layer of powder on a moving conveyor belt and finally rolling the sintered layer. In an alternative method, molten aluminium may be sprayed on the moving belt until the layer deposited is of the required depth.

In the manufacture of sintered nickel steels, iron powder of high purity is mixed with from 2 to 14 per cent carbonyl-nickel powder, and from 0 to 0.7 per cent of fine graphite powder. From such mixtures flat rods may be pressed at 6 to 8 tons/sq. cm. pressure, followed by sintering at 1,220°-1,280°C., either in a single process or in two stages. When by high sintering temperatures and long sintering times a good diffusion is obtained, sintered alloys

can attain similar properties as the corresponding molten alloys.

Stainless Steel Powder

The production of nickel-chromium-molybdenum steel powder for compacting has been described by A. H. Grobe and R. Hoffman (*Nickel Bulletin*, April, 1952). The article describes a steel powder of Type 316 composition, carbon 0.1-2.0, nickel 11, chromium 17, molybdenum 2.5, and silicon 2.5 per cent approximately, produced by water jet disintegration of molten steel and subsequent de-watering and screening. Shape and size of the powder particles is controlled by adjustment of the jet stream. The mode of production ensures retention of the composition of the original melt, and the powders are mixed, for sintering, to ensure a suitable proportion of particles having relatively smooth surfaces with some irregularly shaped particles; a mixture which has been found to give especially good results for moulded compacts. Carbide die parts are required, while suitable lubricants are stearic acid, stearates and waxes; the sintering atmosphere should be highly reducing and the dew point very low.

Laboratory tests carried out by the Vanadium Alloys Steel Co. on powder compacts so made were very satisfactory. These compacts were prepared from -100 mesh powder, compacted at 30-50 tons/sq. in., and sintered for 45 minutes at 1,150°-1,285°C.

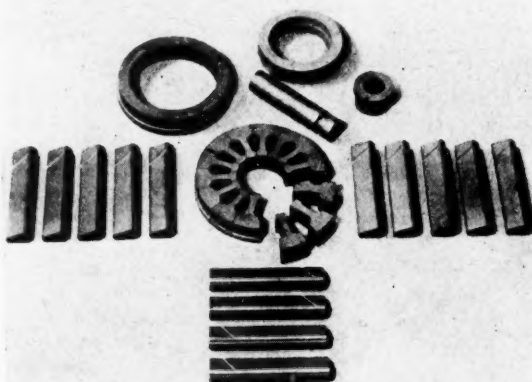
Powder Compact Tests

Test results may be summarized as follows: the powder can be successfully sintered at a temperature as low as 1,150°C. with resultant tensile strengths, for single sintering treatments, of 17,000-29,000 lb./sq. in., and elongations of 5-6 per cent. The maximum tensile properties obtained by double sintering at 1,285°C., with a coining operation between the sintering treatments, are 56,000-76,000 lb. sq. in., with elongations of 17-31 per cent. The maximum weight loss in hydrogen was 0.29 per cent, after correcting for carbon loss. A shrinkage of 1.2-1.5 per cent was obtained by sintering for 45 minutes at 1,245°C. Qualitative data on green strength led to the conclusion that a compacting pressure of 40 tons/sq. in. will produce compacts which will withstand ordinary commercial abuse.

Since the powdered steel parts are sintered in a highly reducing atmosphere, they are slightly more susceptible to corrosion than stainless steel of comparable composition produced by other methods. This limitation may, however, be corrected by a short passivation treatment in nitric acid, followed by a water wash.

Resistance to Wear

An outstanding quality of stainless steel powder parts is their resistance to wear and galling. A major application of stainless steel powder in the engineering field is for small driving arms used in the intermediate gear trains of water meters; while powder-produced steel has also replaced cold-drawn stainless steel tubing for sleeve bearings and bushings in some industrial meters used for measuring nitric acid and other corrosive liquids. Other applications include the making of small gears, cams and levers in various types of mechanism. The cost of pro-



Products of powder metallurgy. The various components for a lamination die, constructed in cemented tungsten carbide
(By courtesy of Murex Ltd.)

duction and lack of suitable press capacity are still limiting factors in the development of stainless steel powder parts, but due to the negligible scrap loss and the reduction in machining required, the final cost of powder-produced parts is stated to be competitive with that of other processes.

Nickel-Copper

A study of the interdiffusion and sintering in nickel-copper compacts has been made by J. M. Butler and T. P. Hoar (*Journal Inst. Metals* 1951-1952, 207). Work is described in which the progress of interdiffusion in copper-nickel compacts was followed by metallographic examination of the compacts, which had been stained, at room temperature, with the vapour from aqueous ammonium polysulphide. This liquid quickly produces interference films of cuprous sulphide on copper-nickel solid solutions. Speed of film formation and consequently the colour after exposure, is controlled by the copper content, thus making possible a rough estimate of the rate of interdiffusion.

Cylindrical compacts, 5 mm. in diameter by about 3.5 mm. long, were prepared, without a lubricant, using a compacting pressure of 20 tons/sq. in. and the following powders were made: nickel powder alone; an equal mixture by volume of copper-nickel, mixed by tumbling; and the same mixture mixed by tumbling and then reduced in hydrogen at 310°C. for 24 hours, with constant shaking. The compacts were sintered in a Chevenard differential dilatometer and at temperatures of 500°-700°C. a large expansion was observed, and production of fissures caused by unequal metallic interdiffusion. These effects were not found in pure nickel or pure copper compacts. When the temperature was increased to 700°-800°C. sintering shrinkage began.

The experiments indicate that although interdiffusion

and sintering may occur simultaneously they are not causally related, and that interdiffusion can, in the early stages of heat-treatment, produce porosity, and cause expansions which are the reverse of sintering. From the observations made it is concluded that neither interdiffusion nor self-diffusion is important as a mechanism for metal transfer in the sintering of metal powder compacts, which is believed to occur rather by plastic deformation, such as slip or creep, of mechanically weak hot metal under the action of surface forces.

Magnetic Tests on Sintered Compacts

Magnetic investigations of sintering in a nickel-copper alloy have been made by W. Köster and J. Raffelsieper (*Zeitsch. für Metallkunde*, December, 1951). The composition of the alloy was nickel 89, copper 11 per cent, prepared from carbonyl-nickel and electrolytic copper powders. The compacts were heated in purified hydrogen for periods varying from 1 to 65 hours, at temperatures between 800° and 1,200°C. Notes were made on the effect of heating time on composition, and the effects of temperature, by means of measurements of the magnetization-saturation values of the alloys, as a function of temperature. Nickel-copper was specially chosen as being suitable for a fundamental investigation of the kinetics of the sintering process, because Cu and Ni form a continuous series of solid solutions; while alloys of these metals with up to 34 per cent copper are ferromagnetic.

Components made of cemented tungsten carbide are being increasingly used and the use of this material for the manufacture of inserts in the mining field has grown enormously in the past few years. Drilled stems with hard metal inserts are now in general use in all the mining areas of the world.



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South Africa

By Our Own Correspondent

THE past and the present years are likely to go down in the economic history of South Africa as of great significance. So far as fresh developments are concerned, the immense potentialities of the uranium content of gold-bearing reefs over a vast area have become manifest and we have proof positive that the high hopes of the new Far West Rand and Free State goldfields suggested in the original drilling programme will be more than justified.

The reverse side of the medal reflects the continuance of two problems which can only be solved by radical changes in what have been accepted practices since the start of gold mining operations. These are the provision of adequate supplies of capital for new expanding ventures and the inadequate supply of Native labour which, although it may be temporarily overcome, is going to be a continuing factor in the future.

Rising Costs

The past year for the producing gold mines has been anything but an encouraging one. Costs have risen steadily—2s. 4d. per ton during the calendar year of 1952, equivalent to 12s. per f.o.z. This has entailed a steady decline in the working profits of the established producers, which so far as shareholders are concerned, has been aggravated by the steady fall in revenue from premium gold sales.

This trend of working costs is largely due to inflationary influences, the corrective effect of the fall in commodity prices over the past year not having filtered through to the mining industry. There are two other factors at work—the shortage of power and of labour.

Effects of Power Shortage

The shortage of power will be corrected in due course, but it is likely to continue longer than was hoped owing to the demands of the developing mines and the uranium industry. In consequence, the great majority of mines are milling below capacity. The power question is also linked up with the labour shortage. In recent years, where possible, an increased degree of mechanization has been introduced underground, but this cannot be carried out to full advantage owing to the rationing of power supplies, which means reduced efficiency. Were it not for the contributions of the new gold mines—four in all—the physical output of gold, apart from profits, would be making a poor showing.

To bridge the gap between the present and the time that sufficient power will be available, the mining industry and the Electricity Supply Commission are working in close collaboration. A system of voluntary rationing administered by the mines themselves has been put into operation. As a result of this, the optimum use is being made of the power available and at no time has it become necessary for Escom to shed loads by the sudden cutting off of supplies. In addition, one or two of the developing mines have taken direct steps of their own accord to install supplementary Diesel-driven plants to help them out.

Incidentally, the power shortage has speeded up the installation of full milling capacities at new mines. A typical example is Doornfontein G.M. on the Far West Rand. It has been decided that the initial plant capacity

will be 48,000 tons a month, which allowing for power cuts, means that the average milling rate will initially be 24,000 tons a month. This will be achieved by crushing at a high rate at off-peak periods. As the power position improves, the milling rate can be stepped up. This is now almost general policy for all the mines coming into operation within the next year or so.

Changing Methods of Finance

It will be realized from this that the capital requirements of the new mines are being compressed into a shorter period than was at first envisaged. Coupled with the general shortage of capital, the mining industry has, therefore, had to give serious consideration to other methods of raising funds than prevailed in the past.

The basis of the new system is the issue in varying forms of interest bearing loan stocks, the rights of conversion into ordinary shares differing from one company to another. Actual public participation in these has been small—in fact in a number of cases the public has not been invited to participate—but it has tapped very large sources of funds from investment corporations.

There are signs at the present time that there is more straightforward risk capital becoming available for new undertakings, but it is doubtful whether we shall ever see the return of the days when a mine could be brought to the production stage on this method of finance alone.

Apart from the fact that the world demand for this type of money is going to remain at a high level for many years to come, the cost of such an enterprise—in the case of the average gold mine at the present time around £11,000,000—can only be met by changed methods of financing.

The Labour Supply and the Limits of Mechanization

The problem of labour supplies will be overcome in due course. The obvious solution is theoretically simple—increased mechanization and the more efficient use of available African workers. Its translation into practice is, however, fraught with major obstacles. The over-riding one is that the mining industry is founded on a system of migrant labour under which the recruit signs on for roughly a calendar year and thereafter returns to his family. It has been the consistent policy of all South African Governments that the Native family unit is a rural one, and that the breaking down of this could have the most serious repercussions on the social and economic life of the Africans as a whole.

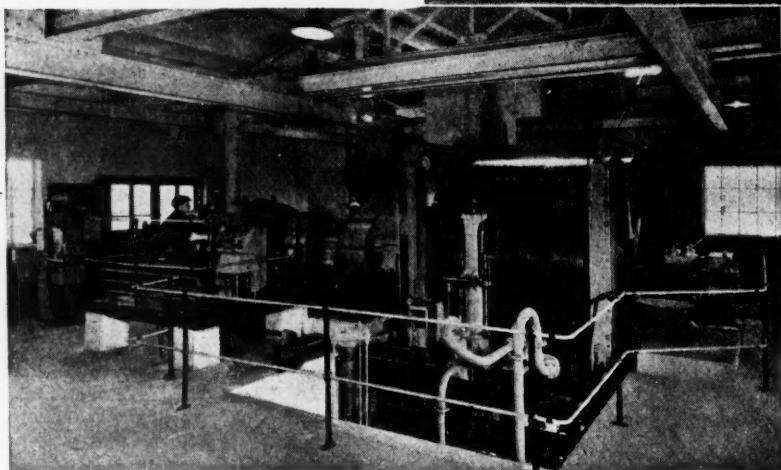
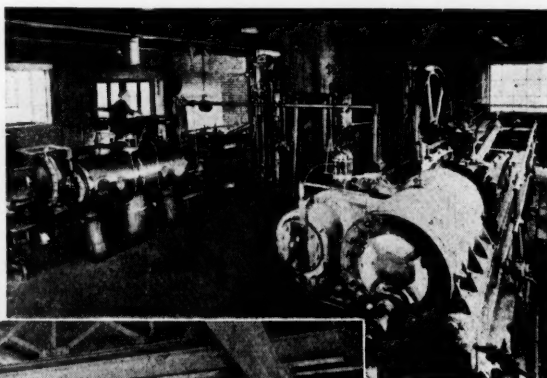
Mechanization, however, can only be economically sound if the worker is employed for a relatively long period. The question that has to be faced is whether the establishment of the families in mining areas—in other words the urbanization of a large section of the Native population—is desirable in terms of the national well-being in its broadest sense.

At the same time, reef formations place a technical limitation on the degree of mechanization possible. In no gold mine is there anything in the way of large ore bodies and there is yet much progress to be made in devising

THE GOLD MINING INDUSTRY'S PERFORMANCE

	1951	1952
Milled, s.tons	58,645,800	60,500,000
Yield per s.ton, dwt.	3.756	3.767
Working revenue	*£137,494,860	†£141,271,310
Working revenue per ton	46s. 11d.	47s. 1d.
Working costs	£93,494,860	£102,525,003
Working costs, per ton	31s. 10d.	34s. 2d.
Working costs, per oz.	169s. 6d.	181s. 6d.
Working profit	£44,157,054	£38,746,307
Working profit, per ton	15s. 1d.	12s. 11d.
Dividends	£22,787,806	£19,804,928
*Excluding £3,699,124 from premium gold		
†Excluding £3,699,124 from premium gold		

Conversion from steam to electricity



In keeping with the National Coal Board policy of modernisation of coal winding equipments, old steam engine-driven winders are being scheduled for gradual replacement by electric drives.

Two important factors influencing the change are increased output and improved shaft efficiency.

The illustrations show a winder house before and after conversion. The final phases of this conversion from steam to electric drive

were carried out during the holiday week shutdown, and the electric winder was ready for work immediately the colliery re-started. The winder is of the geared 3-phase A.C. type with a 50-cycle, 3,300 volt, 900 h.p. 'ENGLISH ELECTRIC' motor operating at 600 r.p.m. (synchronous).

In addition to conversion schemes, 'ENGLISH ELECTRIC' carry out the design and installation of new equipment and also modifications to existing electric winders.

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mechanical means of dealing with, for example, rock handling in narrow stopes.

It is mainly for these two reasons, that there has been virtually nothing new in mechanical techniques over the past year. It has been a period of consolidation of methods introduced earlier, of ironing out of technical difficulties and, above all of studying the best means of training Native operatives to work the various types of machines, and how to obtain from them, under the present migrant labour system, an economic return.

The Impact of Uranium

This is the broad background to the gold mining industry at the present time. The situation, however, has been improved, and at the same time complicated, by the decision to undertake the recovery of uranium on a far greater scale than was originally planned. A year ago little more was known than the bare fact that six mines on the Witwatersrand were to erect plants for this purpose. Since then, the total has been raised to sixteen, and it would appear that this is by no means the end. There is the distinct possibility that, in due course, practically every property underlain by uranium-bearing reefs will come within the scope of the scheme. Although uranium occurs in all reef formations, the economic deposits are in the upper reef of the Witwatersrand series, embracing the Bird, the Kimberley and the Carbon Leader—Vaal—Basal group reefs.

The price to be paid for uranium is a top secret as is the quantities to be produced. One figure of gross earnings has been given as £40,000,000 a year, but it has not been divulged how many mines this refers to. When this is matched with an annual revenue from gold of around £141,000,000, the magnitude of the uranium scheme can be got into some sort of perspective.

So far, one company—West Rand Consolidated—is actually producing. During the last quarter of 1952, which cannot be regarded as typical since the plant was being run in, a net profit of nearly £125,000 was earned from uranium recovery, against just over £400,000 from gold. On this basis, the estimate of £40,000,000 in revenue may be well on the conservative side. By the end of this year, however, a clearer picture will emerge, as the recovery plants at Blyvoor, Daggafontein, Stilfontein and Western Reefs will be in operation. They will cover the various uranium-bearing horizons, thus providing a fair sample from which the long-term prospects of all the mines under the scheme can be estimated.

Apart from the implications of uranium production in terms of increased foreign exchange resources and increased dividends, in the long-run the most important aspect is the lengthening of the productive life of quite a number of mines. This has been fully appreciated by the South African Government, and the policy now adopted is that every assistance must be given towards the exploitation of the uranium bearing ores of the low-grade producers, and of those mines whose lives as gold producers are running out.

Joint Recovery Plants

The cost of a uranium recovery plant is heavy—between £1,500,000 and £3,000,000 depending on its size. It is obvious, therefore, that a mine with limited quantities of ore cannot justify expenditure of this order. Future developments will thus see the erection of joint plants for the treatment of slimes from two or more properties with the capital loans repaid on a joint basis.

This scheme is already being put into operation in the Free State where two recovery plants will serve five mines of the Anglo American group. In addition, a similar plan will operate for the mines of the Strathmore group, as

indicated in a speech of Mr. Jack Scott, the chairman, when he said that the enlarged uranium plant being erected would deal with slimes from other mines.

Two New Gold Producers

The past year has seen two new producers come into operation on the Witwatersrand—Stilfontein and West Driefontein—both of which have shown most gratifying results. During the second half of 1952 they produced between them 215,585 oz. of gold valued at nearly £2,686,000.

Development at Stilfontein has been running at a consistently high percentage of payability coupled with satisfactory values. In consequence of this, the expansion of the capacity of the reduction plant from 50,000 to 80,000 tons a month is now under way instead of taking some years as was originally planned, and should be reached by the end of this year.

The West Driefontein plant is still below its initial nominal capacity of 50,000 tons a month. It will eventually be built up to 125,000 tons a month, at which figure there seems little doubt that it will rank as the richest gold mine in the world.

Progress in the Klerksdorp Area

Current developments in the immediate area of Klerksdorp on the boundary of the Orange Free State continue to be most interesting. Good progress is being maintained with the "grass-roots" mine at Ellaton G.M. and it is expected that it will be in production by the end of the year.

Work has started on Anglo-Transvaal's new mines—Hartebeestfontein G.M.—immediately to the south of Stilfontein, which is underlain by the identical formation found in the latter's property. This company has overcome the power shortage so far as shaft-sinking is concerned by building its own 3,000 kW. plant. Shaft-sinking has started and is expected to intersect the Vaal reef at about 3,000 ft. It will be a 21 ft. dia. circular shaft, concrete-lined throughout, similar to those sunk at Virginia and in progress at Merriespruit in the Free State. The initial milling capacity will be 50,000 tons a month, which stage should be reached in the third quarter of 1955.

A similar mine will be opened up in due course, but under the technical control of Strathmore Consolidated, on Buffelsfontein, south of Hartebeestfontein. It seems probable that little will be done in this respect until Hartebeestfontein is well ahead with its work, partly on account of the general capital position and partly in order that the full benefit may be gained from the technical work on the first mine.

Drilling is still continuing in this area around Klerksdorp, but so far the results have been somewhat mixed and it is impossible to decide at this stage whether yet another mine will be formed in due course.

Drilling in the Far East Rand

At the extreme opposite end of the Witwatersrand, drilling is taking place in the Bethal-Kinross-Delmas area to the east of Springs. It may be recalled that this area was investigated some 15 years ago by the Far East Rand organization without success. Work is now in progress under the aegis of the Union Corporation, who have registered a few companies with nominal capitals to cover the area.

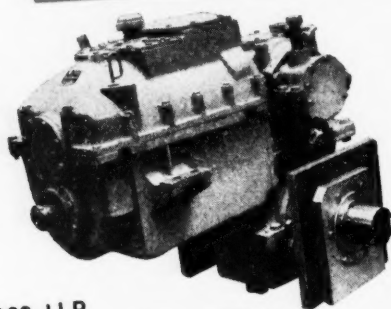
It is too early at this stage, apart from the lack of any official news of drilling results, to pass judgment on the possibilities. Nevertheless, drilling techniques have improved immensely since the early days, and it may well be that reef formations may have been missed or so ground away as to make them appear valueless at that time, as

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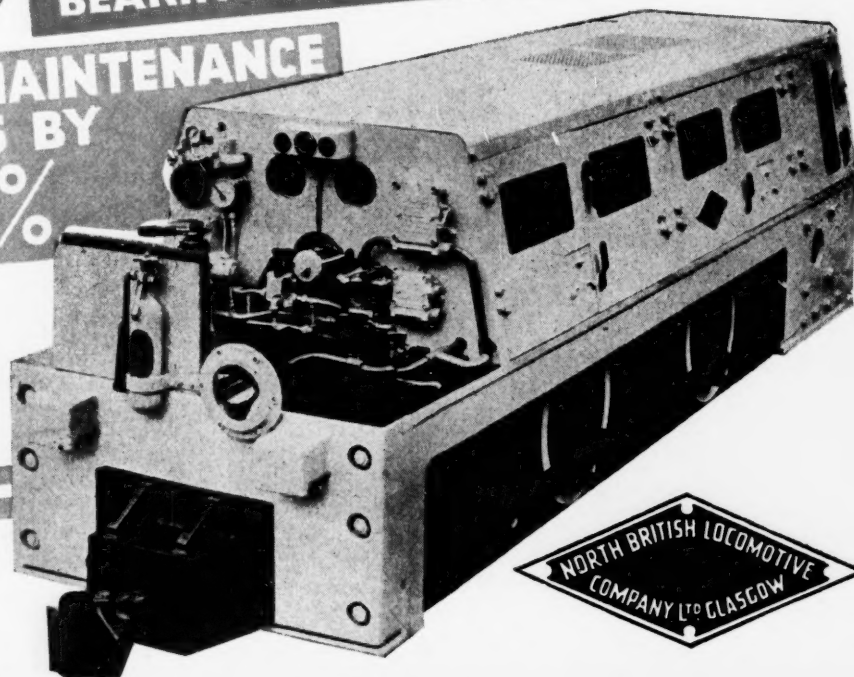
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was the case at Ellaton G.M. where the Vaal-Basal reef failed to attract attention in pre-war drilling operations.

O.F.S. Coming Into Production

The new gold mines in the Orange Free State are emerging from the purely exploratory into the developing and producing stage. It is now clear that almost without exception they will turn out to be even richer than the original drilling programme suggested, and furthermore that the whole area can be regarded as one huge uranium deposit.

In the meantime, drilling is gradually slowing down as the known reef areas are being demarcated. This, however, does not necessarily mean that all the economic deposits have been discovered. There are indications of others existing, but in view of the shortage of capital funds, all that is available will be devoted to bring the properties in existence to the production stage, before any major move to investigate potential new ones takes place.

At the present time, the reduction plants at four new mines are being run in—Western Holdings, President Steyn, Freddie North and Freddie South. By the end of this year, production will also start up at Virginia.

The high cost of bringing a modern mine to production has made it necessary to install plants with far higher capacities than was originally planned. Free State Geduld, Welkom, President Steyn and President Brand are all now scheduled to reach 125,000 tons a month as soon as possible. To finance this programme, an amount of £17,500,000 was raised last year, of which a maximum of £10,500,000 will come from shareholders. Western Holdings is to mill 75,000 tons, the money for which has already been provided.

Virginia will start off with 50,000 tons a month, climbing to 100,000 tons by 1955. The funds for this are being provided by the Kennecott Copper Corporation of America.

Good Development Prospects

Apart from the mines actually reaching the production stage, the coming year should see the balance of them engaged in underground development, which by all indications so far will reveal good values with percentage payability higher than generally found in the older mines. This possibility is strengthened by the latest available development figures covering the quarter ended March 31. At Western Holdings a greatly increased footage of Basal reef yielded 91.24 per cent payability averaging 618 in.-dwt. At President Steyn the payability on the Basal reef was 83.44 per cent averaging 397 in. dwt.

It has not been all easy going in the opening up of the new fields, particularly in regard to water troubles. Free State struck a bad patch with the flooding of No. 2 shaft in October last year. Large-scale cementation failed to hold. It then became necessary to install a concrete plug at the 5,350 ft. level. The shaft is in the process of being dewatered, and the plug should be reached before long, and all going well development work resumed.

Radiometric logging of boreholes and underground tests have revealed that there are a number of uranium horizons in the Free State, including those with economic gold contents. It would appear that the uranium concentration is high in the northern part of the field, tailing off to some extent, and then reaching its highest level in the Harmony-Virginia-Merriespruit area. In addition, the reef in the Virginia block has a high pyritic content, as a result of which it is erecting a plant to make sulphuric acid for the "U" plants on other Free State mines. The extent of this

undertaking and of the size of the uranium leaching plant to be erected on this property is such that the cost will be around £4,400,000 to be financed by loans from the Atomic Energy Board.

The two main areas at present being explored which will form the basis of yet two further mines are Zaaiplaas, immediately north of the Harmony mine and the Van Den Heversrust area adjoining Freddie's and Loraine. The first has disclosed a series of excellent values and it should not be long before a mining lease is granted. The V.D.H. ground, which contains the famous "Rainbow" reef formations is gradually yielding up its secrets, and it is understood that steps towards the formation of the first mining company, which will be controlled by Anglo-Transvaal Consolidated will be taken before the end of 1953.

Other Metals

Mining activities, other than gold, had a record year in 1952. Base mineral production was valued at nearly £44,200,000—15 per cent greater than in 1951. This figure would have been even greater but for the shortage of rail

transport which cut down exports of manganese, chrome and coal—a total embargo being placed on export by Transvaal collieries during the greater part of the year. The position, is, however, easing, and the current 12 months may well see a considerable improvement.

The greatest activity was in the field of asbestos mining, where many of the new undertakings passed into the production stage. Most striking were the chrysotile figures which were 24,680 tons valued at £2,238,000,

against 14,489 tons valued at £1,070,000 in 1951. With the weakening of demand over the past half-year, activity has died to some extent and it would not be surprising to see some of the smaller producers go under. Considerable research work is being done in milling and grading techniques which, if successful, should put the industry—particularly the amosite section—on a more competitive basis.

Antimony production at Consolidated Murchison suffered a major setback with the collapse of the market in this metal. Activity has been reduced, and the outlook is still highly unsettled.

With the high price of copper, 1952 was a most profitable year for the major producers, although the actual output was down. Nevertheless, expansion is proceeding. The new ore body at Messina looks most promising and the plant has been extended and modernized. At O'okiep, a new ore body has been discovered, with ore reserves estimated in the middle of last year in excess of 3,000,000 tons containing 3 per cent copper. Shaft-sinking in this area has now started.

Tin production has also been climbing. In addition to the two older mines, Union Tin Mines is building up its plant to increase its capacity and improve extraction. An interesting development is the opening up of the Vellefontein area near the Rooiberg mine. Development so far has yielded 100 per cent payability with values running between 1.88 and 4.87 per cent M.T.

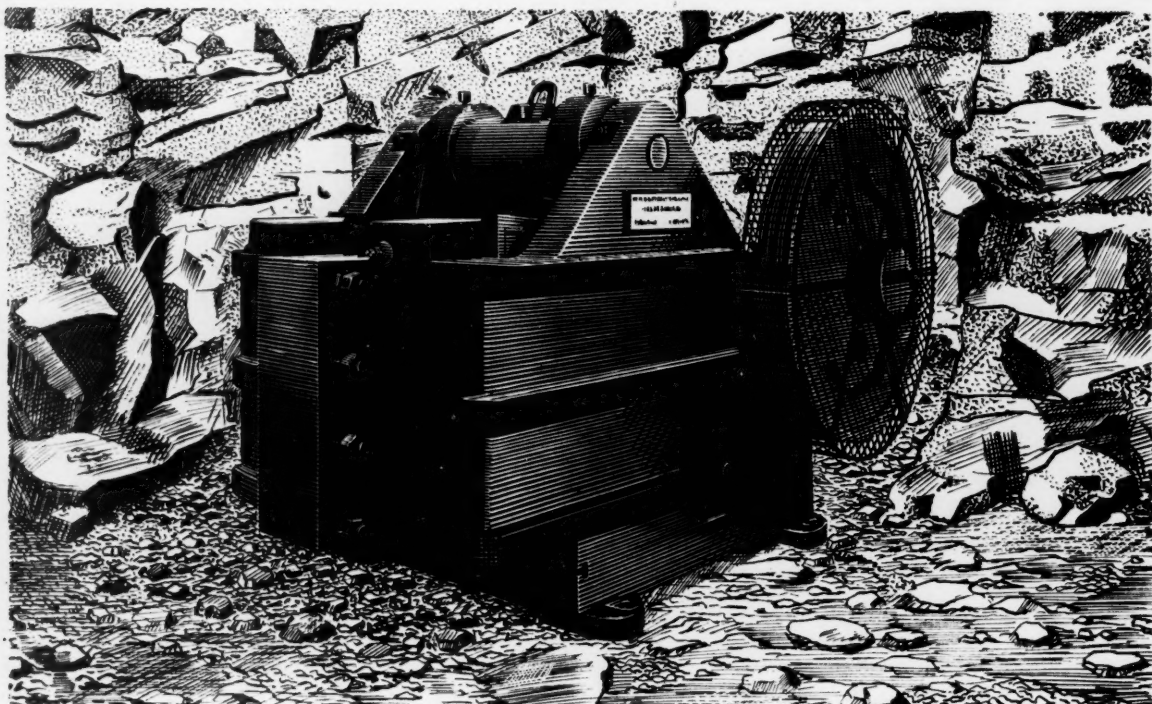
During the year, the Anglo American Corporation made a start with opening up a monazite deposit on the North-Western Cape. Annual production is expected to be about 8,000 tons of concentrates containing 55 per cent rare earths and thorium.

A number of deposits of ilmenite have been discovered in the Natal area. One of these is expected to start producing in June this year. Despite the numerous articles on the "wonder metal" titanium in the popular Press, it is however doubtful whether its use has grown to the extent

BASE MINERAL SALES (in tons)

	1951	1952
Antimony	28,211	11,229
Asbestos		
Amosite	49,845	58,032
Blue	36,900	40,954
Chrysotile	14,489	24,680
Chromite	564,017	458,785
Coal	28,737,000	30,038,000
Copper	38,533	37,606
Iron Ore	1,560,277	1,933,186
Manganese	704,133	709,248
Tin	808	997

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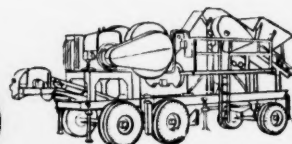
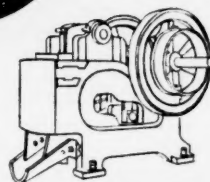
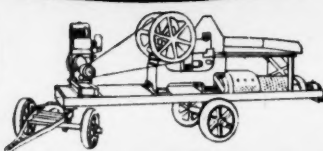
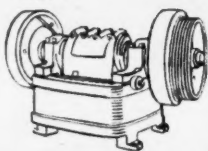
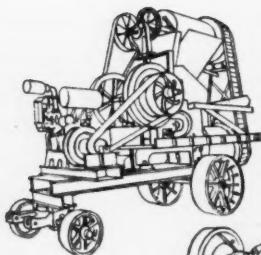


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Sales of platinum metals rose during the year to 172,766 oz. valued at £4,135,866, compared with 145,395 oz. valued at £3,405,452. The increased milling capacity at the Rustenberg mines has now been attained, but as it takes some eight months before the metals reach the market, the effects will not be felt for some time.

Iron and Coal

Good progress is being made with the opening up of the iron ore deposits at Postmasburg which will supply the additional requirements of Iscor. Plant to crush and screen 500,000 tons of ore a year is being installed. The installation of the Krupp-Renn plant to treat titaniferous iron ore in the Eastern Transvaal is going ahead.

Work is going ahead with the £2,000,000 Government sponsored phosphate plant to exploit the deposits at Palabora in the Eastern Transvaal. Production is expected about the middle of next year. Initial output is estimated at 56,000 tons of concentrates a year, building up to 150,000 tons.

The major developments in coal mining have been the opening up of two anthracite collieries in Natal (both of which are making good progress with expanding capacities), and the start of work on the major colliery, south of Johannesburg, to supply the State sponsored oil-from-coal plant. Its ultimate capacity will be between 1,000,000 and 1,250,000 tons a year.

South-West Africa

The largest mining undertaking in South-West Africa continues to be that of the Tsumeb Corporation on the lead-copper ore body. The new 4,000 ft. vertical shaft is expected to be completed this year. It has already been connected with the present workings on the 2,000 ft. level. On the completion of this work the tonnage handled is

expected to increase to around 2,000 tons a day. The mechanical loading plant at Walvis Bay is now reported to be in commission. An interesting development is the research work being done towards the recovery of germanium from the lead-zinc concentrates.

A possibility of further activity in this area is reflected in the large concession granted to the Anglo American Corporation adjoining Tsumeb on the west and extending nearly to the Kakaoveld. A small high-grade deposit of copper is reported at Fransfontein.

The Bethlehem Steel Corporation was busy last year organizing an exploration department to explore the company's concession areas in the territory. This concession only became effective in March this year, so that it will be some time before any results can be expected. Other iron deposits are being investigated, and it is reported that the Rio Tinto Co. may be interested in them. Occurrences of coal are said to have been made in Ovamboland—the first in South-West Africa—and exploratory work is reported to be in progress.

A most interesting development has been the opening up of manganese deposits by S.A. Minerals, about 100 miles north-east of Okahandja. Profitable shipments have been made to the U.S.A. Production is expected to increase during the current year. Estimates of exports vary between 4,000 and 10,000 tons a month.

Development work by Uis Tin Mines near Omaruru on pegmatite deposits are stated to have given encouraging results. Production on a limited scale is taking place with a small plant. In due course, it is planned to expand this to handle 1,000 tons of ore a day, a rate which it is hoped will be achieved during the current year. The company recently announced that pegmatites had been disclosed in development work containing economic quantities of tantalite-columbite.

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Mocambique

By Our Own Correspondent

IT is common knowledge that the mineral resources of Mocambique have not been well explored. So, perhaps, the most important event of the year past, in so far as the mining industry is concerned, was the decision by the Government to take advantage of E.C.A. funds and to have an American field mission carry out a survey of the mineral prospects of the Colony.

A Hint of Uranium

The uranium-bearing davidite near Tete and the Alto Ligonha pegmatite bodies will claim first attention. After the first excitement, lack of capital and technical direction proved an obstacle to any thorough development of this radio-active field. A Government survey group gave much time to a geological study of the formation and found the radio-active content through the deposit to be most erratic.

There is much in the Alto Ligonha pegmatites that would repay a close experienced survey. Tantalite, mica, probably one of the best beryl occurrences in Southern Africa, gold and semi-precious stones, are to be found, but here, again, poor technical administration has brought the company to a near state of bankruptcy.

In order to prevent haphazard pegging wherever the American field party should be working, most of the Colony has been closed to public prospecting. This is to some extent detrimental in its long term effect. Geological surveys of such a nature as this sponsored by the E.C.A. find their attention concentrated on the known field since their time is not unlimited. It is the individual prospector, following his haphazard path where it may lead him, who stumbles on the valuable mineral far off the beaten track.

Whereas coal begins to find a higher level in the economy of the country due to the efforts and financial expenditure of the Belgian administrators of the company, gold is hardly worth a mention. There are no new deposits being worked. Production decreased almost to nothing and there does not appear to be possibilities of any immediate improvement. As for coal, the high ash content of the upper seams at Moatize has always been a problem and all experiments have emphasized the dire need of a washing plant and no doubt this will be eventually installed.

New discoveries of interest are limited to the occurrence of tantalite near Vila Machado. Further work on the pegmatites have shown the overburden and rubble, which contains tantalite running about three-quarter per cent, to be more extensive than was at first thought.

Other Deposits

Some interest has been shown in the chalcopryite deposits near Tete and this may prove worth while, but it is doubtful whether an extremely large tonnage will be proved. The various galena deposits near Chicoma and Changara have not proved valuable enough to overcome the tremendous disadvantages of an unhealthy climate, long transport distances to rail head and generally unattractive conditions for exploitation. If these deposits are the relics of the fabulous silver mines of ancient Chicoma they do not at this stage of lack of communications invite exploitation.

Drilling for oil near Lourenco Marques continues but with bigger drills and it is from this source that the greatest expectancy of mineral prosperity is awaited.

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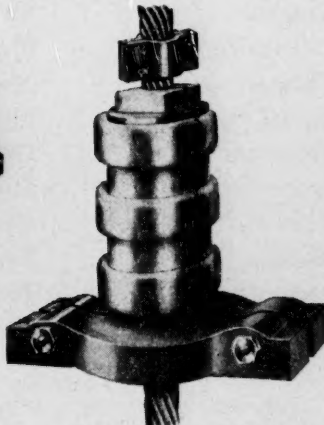
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Southern Rhodesia *By Our Own Correspondent*

A RECORD year for base metal mining in Southern Rhodesia brought the total value of base mineral production from the commencement of operations until December 31, 1952, almost to £100,000,000. To that date the gross output of the mining industry totalled £292,345,291, of which £191,433,419 was the total value of gold outputs (including all premium payments), £99,957,710 was due to base mineral production and the balance of £954,162 came from silver, diamonds and other precious stones. Mineral production as a whole in 1952 was valued at £20,201,282, comparable figures for recent years being: 1951—£15,084,654; 1950—£13,606,706; 1949—£11,293,201; and 1948—£8,899,134.

New Royalty Rate for Chromite

To some extent the 1952 figure is abnormally inflated by the decision of the chrome mining companies to declare their stockpiles; nevertheless after making due allowance the increase recorded is the highest for any one year. From July 1 a new rate of royalty came into force. Formerly the royalty payable to the Government (which acquired the mineral rights from the British South Africa Company in 1933 at a cost of £2,000,000) had been 5d. per ton on chromite outputs exceeding 100 tons; now it is 4 per cent of the output value—an average of nearly 4s. a ton at current market prices.

Until this change was made, royalty was payable on the amount of chromite actually shipped, this arrangement having arisen from the inability of the Rhodesia Railways to transport all the ore raised. Stockpiles totalling 506,158 tons had consequently accumulated at grass.

When the new rate of royalty was announced the mining companies, very reasonably, pointed out that, but for the railway transport bottleneck, all this ore would have been shipped long ago and the old rate of royalty paid on it. The Government accepted this argument and permitted declaration of the stockpiles at the old rate. The stockpile, plus the June railing of 33,797 tons, was officially valued at £2,590,893. As a *quid pro quo*, the Government ruled that henceforward all chromite outputs should be declared at the time of mining, irrespective of whether a portion had to go into stock for lack of transport to the coast.

Support for Gold Mining

Asbestos in 1952 achieved a bigger output value than gold for the first time. Despite the Government's decision to permit premium sales of all gold produced (instead of 40 per cent), which resulted in a slight increase in the volume of output for the first time since 1949, the 496,731 f.o.z. declared were sold for £6,519,915 compared with £6,651,975 received for 84,834 tons of asbestos fibre.

The 1952 Budget showed a tendency to use some of the prosperity of the base metal enterprises, to bolster up the declining gold mines. The new flat rate of royalty (4 per cent *ad valorem*) on all coal and base minerals was expected to increase the revenue from this source by £180,000 in the current year (i.e., £240,000 in a full year). Simultan-

eously, a concession costing £250,000 a year was made by introducing a depletion allowance in respect of income tax. The 10 per cent allowed to gold mines compares with the 5 per cent allowed to coal and base mineral mines.

This concession, coupled with permission to sell all gold at a premium, has tided the gold mining industry over the period when costs were nearing the peak of adjustment following devaluation of sterling. There appears to be a reasonable hope that the working costs of the gold mines will show no further increase and may even fall slightly in the coming months.

The average revenue per ton milled in 1952 was 49.42s., for December it was 51.43s.—and the decline appears to have been halted. In effect the increased premium sales, despite the lower premium paid, has added an average of 6s. to the revenue per ton milled.

Asbestos Boom Goes On

Meanwhile the asbestos boom continues. In 1952 the average price at mine for Rhodesian asbestos fibre was £78.41 per ton compared with £70.20 in 1951, £64.53 in 1950; £50.06 in 1949 and £37.81 in 1948. On a much lower level, the value of Rhodesian chromite has almost doubled since the war. The average price at mine in 1952 was £4.97 per ton compared with £4.63 in 1951, £3.79 in 1950, £3.67 in 1949 and £3.25 in 1948. Disregarding the abnormal declaration of stockpiles, production in 1952 averaged about 30,000 tons a month, which is believed to represent not more than 60 per cent of the market demand for Rhodesian chromite. Railway transport is still a limiting factor. The Korean war stimulated interest in Rhodesian scheelite deposits and the output of tungsten concentrates rose from 65 tons in 1950 to 430 tons in 1952.

Tungsten ranked fourth in the list of base minerals produced in

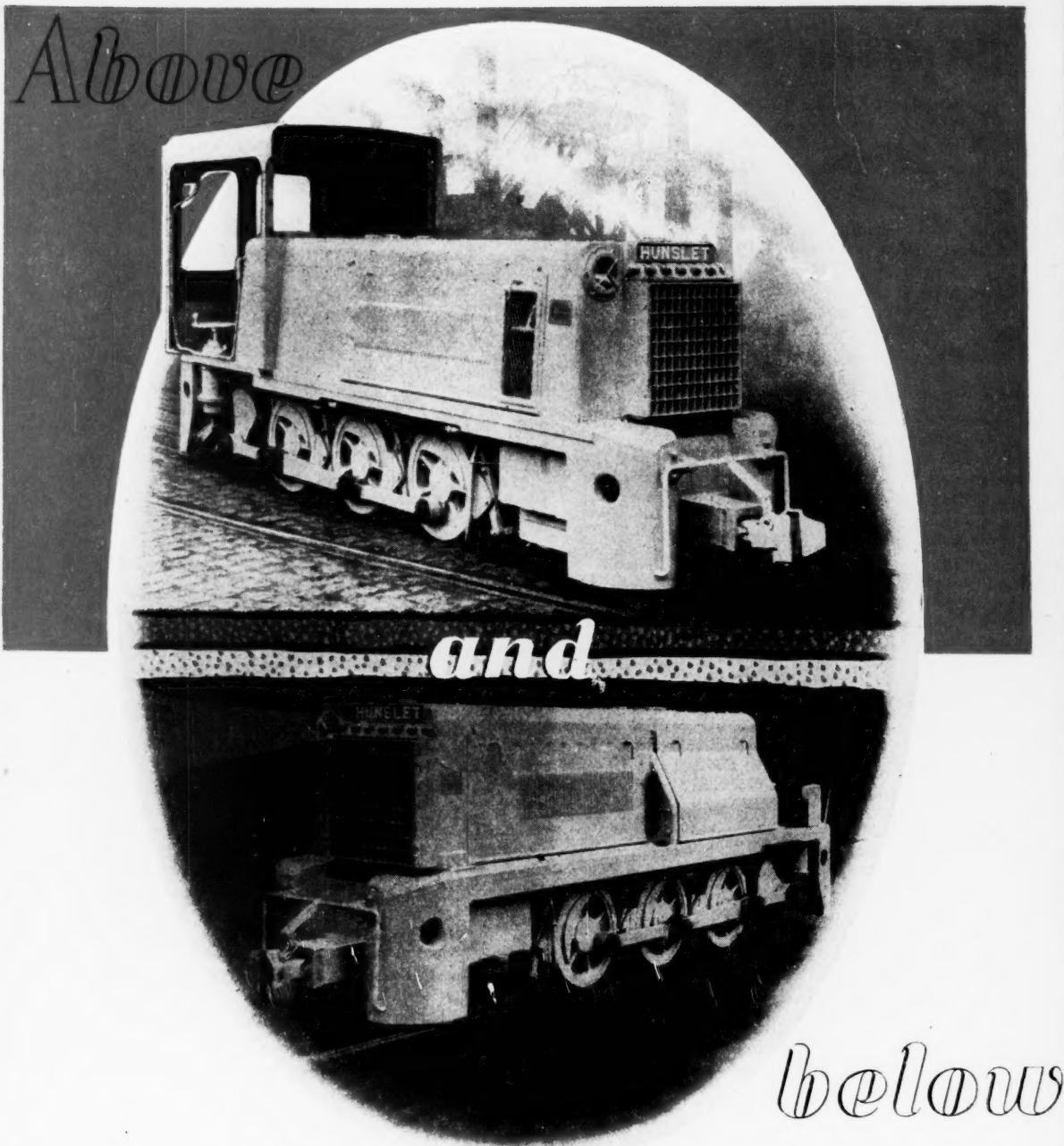
Southern Rhodesia last year, the output being valued at £513,135.

Output at Wankie

An important development during 1952 was the completion of the new north shaft at No. 2 Colliery at Wankie, giving access to a further 20,000,000 tons of coal on the northern boundary of the concession area. Simultaneously work started on the site of the new No. 3 Colliery by which it is hoped to raise annual production to 5,000,000 tons by 1956. This should more than meet the estimated requirements of all Central African consumers at that date. Because of decreasing labour supply available for the uncongenial work of hand-lashing, the underground workings of No. 3 Colliery will be fully mechanized, the coal being cut by machines and mechanically loaded into electric shuttle cars which will discharge the coal on to belt conveyors. Mechanization on a comparatively limited scale is now established at No. 2 Colliery and present plans provide that, when a total output capacity of 5,000,000 tons from all three collieries is reached, 56 per cent of all the coal will be extracted by mechanical means.

BASE MINERAL PRODUCTION

	(in tons)		
	1950	1951	1952
Asbestos	71,527	77,663	84,834
Chromite	321,353	330,989	861,839
Coal (raised) ..	2,345,841	2,535,449	2,821,221
Tungsten (conc.)	65	235	430
Beryllium Ore	932	1,110	1,186
Mica (block, waste & crude)	450	384	836
Limestone	282,704	293,904	435,233
Tin (conc.)	105	95	57
Iron Pyrites	15,223	31,161	21,002
Magnetite	9,496	16,330	12,073
Iron Ore	63,070	57,149	71,465
Copper	129	105	120
Antimony Ore	44	137	229
Lithium Ore ..	200	2,645	1,480
Tantalum (conc.)	—	—	5
Dolomite	—	—	5,985
Arsenic	126	84	568
Fireclay	1,363	1,201	9,200
Quartz	—	—	2,507
Manganese Ore	—	—	1,580
Ochre	—	—	71
Columbite Ore	—	—	0.56
Kaolin	15,340	10,717	4,002
Quartzite	822	363	338
(Arranged in order of financial importance)			



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Northern Rhodesia

By Our Own Correspondent

ATEN per cent increase in value of mineral production was achieved by Northern Rhodesia in 1952, despite substantially lower market prices for zinc and, to a lesser extent, for lead, and despite a three-weeks strike of African mineworkers on the Copperbelt which reduced the total value of output by perhaps £5,000,000. Mineral production as a whole was provisionally valued at £79,254,907. Comparable figures for recent years are: 1951—£72,161,125; 1950—£49,323,357; 1949—£35,579,543; and 1948—£29,771,842.

Copper Output

Blister copper output has risen from 128,749 tons in 1946 to 200,799 tons in 1952 and production of electrolytically refined copper has climbed from 53,540 tons to 111,555 tons in the same period. With a price differential of about £20 a ton, there is a considerable incentive to increase the proportion of copper exported in electrolytic form, as wire bars, cathodes or ingots. Electrolytic copper output in 1952 was provisionally valued at £26,463,604 (compared with £21,043,091 in 1951) and although the output of blister copper was 2½ per cent down in volume, its value was £45,371,488 (compared with £41,166,736 in 1951).

Other important outputs were: zinc £3,792,975 (£5,928,360 in 1951); lead £1,740,500 (£2,364,373); cobalt alloy, £1,048,462 (£1,387,682); and copper concentrates, £544,373 (£8,411). Comparatively minor outputs were: limestone, £122,442; cobalt metal, £71,145; vanadium pentoxide, £56,976; sheet mica, £18,702; tin ore, £8,632; manganese ore, £6,321; and iron ore, £5,943.

Commencement of Refined Cobalt Production

For the first time refined cobalt metal appears in the output returns. Formerly the cobalt left Rhodesia in the form of an alloy with a cobalt content of not more than 40 per cent, the balance being mainly copper and iron. The advantages of exporting a more refined product are obvious, especially as the cost of refining the alloy is more than compensated by the value of the copper recovered. The cobalt refinery plant at the Nkana mine has not yet gone into full production, but the small output achieved in 1952 is a harbinger of greater things to come.

The reappearance of iron ore after two years' absence is also a pointer to future expectations.

Broken Hill New Smelter

An increase in lead and zinc production from the Broken Hill mine is expected in 1953. Recovery from the new smelter should enable production to be increased by 50 per cent without increasing the quantity of ore treated.

Some increase in manganese ore production may be expected as the capacity of the Rhodesia Railways increases and there is a prospect that gypsum will be produced in the Kafue Flats.

Extensive Exploration

Smallworkers are receiving every encouragement from the British South Africa Co., which holds the mineral rights in Northern Rhodesia; but important discoveries are more

likely to be made by the large companies using new prospecting techniques. Prospecting reservations cover territory set in the shape of a letter Y forking from the existing Copperbelt round both sides of the Congo pedicle and extending southward to the Victoria Falls. The arms of the Y are being explored by Rhodesian Selection Trust (Services) Ltd., while Rio Tinto Copper Mines Ltd. have been granted exclusive prospecting rights for five years in areas totalling 9,000 sq. miles between the Congo border and the site of the proposed hydro-electric scheme in the Kafue Gorge south of Lusaka, and Rhodesian Anglo-American Ltd. are to concentrate their exploration activities in the Zambesi Valley south-westward from latitude 16 deg. S. to Livingstone.

Meanwhile the new Bancroft and Chibuluma mines are

being actively developed according to plan. Shaft-sinking has begun on both the Kirila Bomwe and Konkola ore bodies, which together form the Bancroft mine, and when production starts in January, 1958, it is planned to draw 75,000 tons of ore monthly from each. With proved ore reserves of 80,000,000 tons running 3.4 per cent copper, the output capacity of the Bancroft mine is between 4,000 and 5,000 tons of copper per month. At this rate of output the mine has a "life" which will carry it to the end of the present century. Chibuluma is a smaller, but richer proposition, with 7,300,000 tons of ore containing 5.25 per cent copper and 0.25 per cent cobalt. An annual output of 16,000 tons of copper and 500,000 lb. of cobalt is planned to start in four years' time.

BASE MINERAL PRODUCTION			
	(in tons)		
	1950	1951	1952
Copper (blister)	198,760	205,996	200,799
Copper (electrolytic)	77,673	103,146	111,555
Zinc	22,715	22,590	22,890
Lead	13,685	13,970	12,600
Cobalt alloy	1,746	1,836	1,249
Copper (concentrates)	289	188	5,563
Limestone	107,160	169,016	272,094
Cobalt metal	—	—	32
Vanadium pentoxide	—	153	76
Mica (sheet)	2	6	17
Tin (concentrates)	6	4	16
Manganese ore	1,723	1,260	3,926
Iron ore	—	—	5,943
Beryllium ore	—	—	8
Phyllite	—	5,930	7,522
Silica Rock	165	1,012	4,333
Cobalt (other)	—	—	2
(Arranged in order of financial importance)			

Future Level of Copper Production

Even before these new mines (and other prospects) come into production, the copper output of the Northern Rhodesian mines is expected to pass the total current demand for virgin copper in the United Kingdom. Output from existing mines is expected to rise ultimately to 360,000 tons a year and a further 100,000 tons may be confidently expected from new mines now in development.

Coal shortage, though still an irksome handicap, will be a diminishing factor in the next three years, as the third colliery at Wankie comes into production and the capacity of the railway is increased. Meanwhile the copper mines are now burning 1,000,000 tons of forest timber annually in an effort to make good the shortfall in coal deliveries. Substantial reduction in the Copperbelt's dependence on coal is foreshadowed by plans to draw hydro-electric power from the Belgian Congo and the Kafue Gorge scheme.

Labour Situation

The one outstanding anxiety is the risk of labour unrest, leading to periodic curtailment of production. The problem of the industrial colour bar remains unresolved and the growing strength of the African Mineworkers' Union in negotiation has brought nearer the time when this issue must be squarely faced by both the managements and the European mineworkers. Nevertheless, there is a reasonable hope that this issue will be settled amicably and with no lasting disruption of the industry on which Northern Rhodesia is so heavily dependent.

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The Belgian Congo and Ruanda-Urundi

By Our Own Correspondent

LAST year further confirmed the importance of the mining industry to the economy of the Belgian Congo and Ruanda-Urundi. At the date of writing production returns are not available, and export figures are employed, while the values are those supplied by the customs. These aggregated in 1952: B.Fcs.12,107,963,085 or roughly 60 per cent of the total export values. In 1951 the valuation of the mineral exports was B.Fcs.9,769,079,179. The Congo franc to-day has the same value as the Belgian.

Apart possibly from uranium, information about which is not published, copper was the chief product exported, the total for the year being 204,219 tonnes, valued at B.Fcs.6,159,938,818, as compared with 183,930 tonnes in 1951.

Reviewing the chief mineral developments during the year, the Bamoco Syndicate has continued investigations of the copper discovery, referred to in last year's *Review*, some 50 kilometres east of Madimba on the Matadi-Leopoldville railway, connecting the Congo with the Atlantic. Within the last two or three weeks it has been authoritatively stated that geological prospecting and boring will be methodically pursued during the current year, the chief objectives being copper, lead and zinc. Madimba is situated some 170 kilometres south-east from Mindoli which is on the Congo Ocean Railway connecting Point Noire with Brazzaville. M. Chauvet, Governor General of French Equatorial Africa, recently told a Press conference that the investigations now being carried out justified the hope that the superficial deposits now being developed may contain some 40,000 tonnes of copper. Dis-

coveries previously reported some 200 miles north-east of Bembe in Northern Angola were declared in a recent article in the *Diario de Luanda* to possess no real importance.

Another important prospecting operation was that undertaken for oil by Remina (Sté. de Recherches Minières en Afrique) in the great central basin of the Congo. So far only a general geological survey has been carried out and this is now being studied to decide on the location for bore-

holes. Remina is doing this work not for itself but for a powerful Belgian syndicate.

Billiton's Application

Another event of the year was the application made by Billiton for authority to prospect in Ruanda-Urundi. So far the Belgian Government has not seen its way to grant the application because the Trusteeship Council of the United Nations has made representations against any further concessions being granted to whites, as if these are further extended, there will be nothing of interest left for the natives should they wish to start

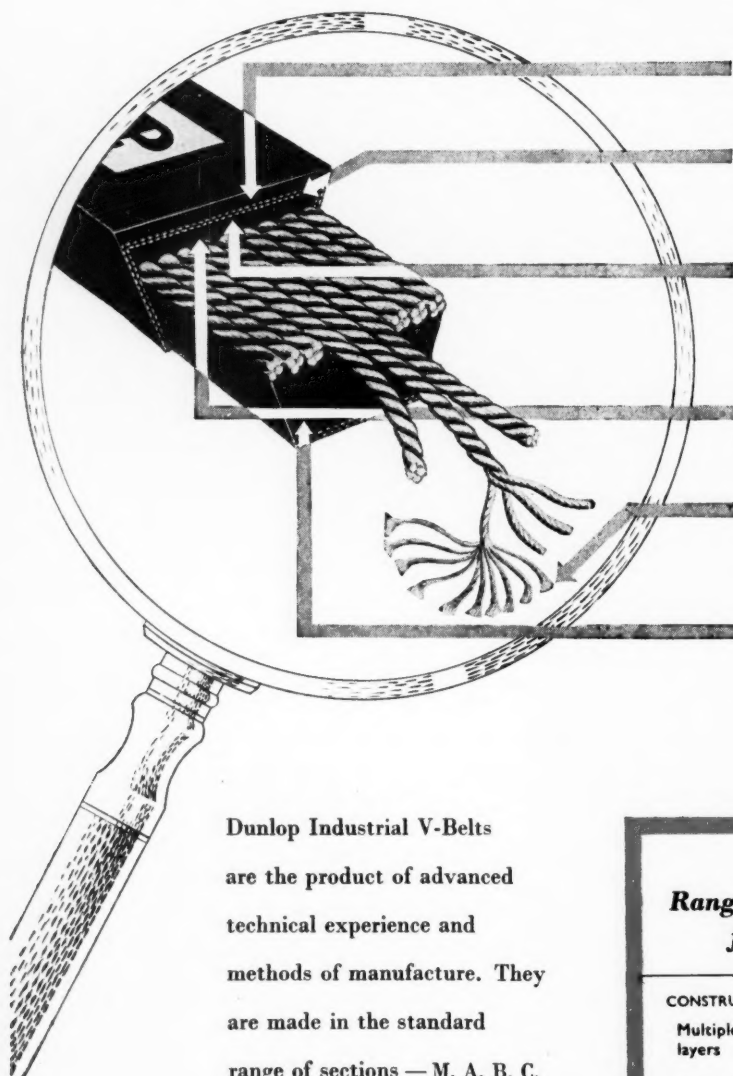
mining. The position thus adopted by the Trustee Council seems at variance with the policy of the U.S. Government not to allow mineral riches to go undeveloped. It will certainly be a very long time before the natives of Central Africa are able financially and otherwise to initiate mining enterprises! In the meantime the Belgian Government has not replied to the Billiton application.

The following is a list of the active mining companies in the Congo and Ruanda-Urundi:

MINERAL EXPORTS			
	Unit	1951	1952
Copper.....	tonnes	183,930	204,219
Cobaltiferous products	kilos	9,708,770	11,608,042
Industrial diamonds	carats	9,714,159	10,985,791
Gem diamonds	carats	617,216	530,167
Tin conc.....	tonnes	13,718	16,036
Tin ingots.....	tonnes	2,713	2,860
Gold	kilos	11,375	13,489
Zinc conc., crude.....	tonnes	116,925	92,186
Zinc conc., roasted.....	tonnes	51,709	46,842
Zinc metal.....	tonnes	0.4	30
Manganese ores.....	tonnes	65,723	127,426
Tungsten conc.....	tonnes	471	854
Tantalum-niobium ores	tonnes	211	207
Silver (smelted locally).....	kilos	1,015	5,249
Cadmium.....	kilos	24,854	19,550
Tantaliferous slags	tonnes	6,824	837
Tantalite ores	tonnes	24	2

Name	Abbreviated Name	Capital (000,000 Francs)	Minerals Mined	Address in Belgian Congo or Ruanda-Urundi (R-U)	Address in Brussels (unless otherwise stated)
Beeka-Manganese	—	20	Manganese	Elisabethville	46, rue Royale
Charbonnage de la Luena.....	—	40	Coal	Elisabethville	10, rue Bréderode
Comité National du Kivu	C.N.K.I.	107	Gold, Tantalite, Tin	Costermanville	16, rue d'Egmont
Compagnie Belge d'Entreprises Minières.....	COBELMIN	5	Gold, Tin, Wolfram	Kindu	91, rue de l'Enseignement
Compagnie de Recherches et d'Exploitations Minières au Ruanda-Urundi	COREM	15	Gold, Tin	Usumbura (R-U)	28, rue du Trône
Compagnie des Mines d'Etain et de la Belgika	BELGIKAETAIN	20	Gold, Tin	Stanleyville	121, rue du Commerce
Compagnie Géologique et Minière des Ingenieurs et Industriels Belges	GEOMINES	200	Coal, Tantalite, Tin	Manono	5, rue du Trône
Compagnie Géologique et Minière du Ruanda-Urundi.....	GEORUNDA	150	Gold, Tin	Rwinkwavu, Kigali (R-U)	24, avenue de l'Astronomie
Compagnie Minière au Ruanda-Urundi.....	MIRUDI	6	Gold, Tin, Wolfram	Usumbura (R-U)	10, rue Bréderode
Compagnie Minière de l'Urega.....	MINERGA	10	Columbite, Gold, Tantalite, Tin, Wolfram	Goma	24, avenue de l'Astronomie
Compagnie Minière des Grands Lacs Africains.....	MILACS	20	Gold	Goma	24, avenue de l'Astronomie
Compagnie Minière du Congo Belge.....	MINGOBEL	22	Gold	Léopoldville	2, rue Montagne du Parc
Compagnie Minière du Nord de l'Ituri.....	COMINOR	10	Gold, Tin	Goma	24, avenue de l'Astronomie
Compagnie Minière en Afrique Orientale.....	MINAFOR	4	Gold, Tin	Usumbura (R-U)	42, rue Royale
Les Mines d'Or et d'Etain de Kindu.....	KINORETAIN	60	Gold, Tin	Kindu	42, rue Royale
Mines d'Or Belgika	BELGIKAOR	79	Gold, Tin	Stanleyville	121, rue du Commerce
Société de Recherche Minière du Sud-Katanga.....	SUDKAT	46	Copper	Elisabethville	6-8, rue Montagne du Parc
Société des Mines d'Etain du Ruanda-Urundi.....	MINETAIN	56	Gold, Tin	Astrida (R-U)	42, rue Royale
Société des Mines d'Or Kilo-Moto.....	—	230	Gold	Kilo and Moto	1 place de Luxembourg
Société d'Exploitations et de Recherches Minières au Katanga.....	SERMIKAT	128	Iron ore, Lead, Tin	Mitwaba	48, rue de Namur
Société Internationale Forestière et Minière du Congo.....	FORMINIERE	230	Diamonds, Gold	Tshikapa	42, rue Royale
Société Minière Cololacs.....	COLOLACS	5	Gold, Tin	Stanleyville	2, rue Montagne du Parc
Société Minière de Bafwaboli.....	SOMIRA	29	Gold, Tantalite, Tin	Stanleyville	41, rue Jean Stas
Société Minière de la Bili	SOMIRI	5	Gold	Buta	41, rue Jean Stas
Société Minière de l'Arwimi-Ituri	—	25	Gold	Stanleyville	41, rue de Naples
Société Minière de Kamola.....	SOMIKA	17	Tin	Manono	48, rue de Namur
Société Minière de la Luana.....	SYLUNA	10	Gold, Tin	Léopoldville	112, rue du Commerce
Société Minière de Muhinga et de Kigali.....	SOMUKI	28	Bastnasite, Gold, Tin	Kigali (R-U)	34, avenue Rubens, Antwerp
Société Minière de Nyangwe.....	—	10	Gold, Tin	Stanleyville	121, rue du Commerce
Société Minière de la Tele	TELE	25	Gold, Tin	Stanleyville	42, rue Royale
Société Minière du Congo Septentrional	SOMINOR	10	Gold	Buta	45, rue Jean Stas
Société Minière du Lualaba	MILUBA	15	Gold, Tin	Goma	24, avenue de l'Astronomie
Société Minière du Surongo	—	17	Gold	Stanleyville	81, rue d'Arion
Symétain	—	85	Gold, Tin	Léopoldville	112, rue du Commerce
Union Minière du Haut-Katanga	—	3,000	Cadmium, Cobalt, Copper, Gold, Uranium, Zinc	Elisabethville	6, rue Montagne du Parc

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16/GM2

East Africa

By W. E. SINCLAIR, M.I.M.M.

IN every part of the country mining activity was characterized by intensive prospecting following up the extensive investigations of the various geological surveys. This work and the development of several large base mineral propositions has made good progress despite the shadow of political unrest in Kenya. Although results from this work can only be realized in the future, a marked step forward in base mineral production is already a feature of the year's working. Base minerals have again overshadowed gold which in every case shows a drop in output. This, however, is offset by the high price obtained on 40 per cent of gold sold in the free market.

Tanganyika

The record value for mineral exports is accounted for by the resumption of sales of diamonds by the Williamson Diamonds at Mwadui. This makes up for the poor revenue returns during the previous two years.

Notwithstanding the drop in gold output export value was maintained, and in the base mineral field there was a definite upward trend in nearly all minerals listed.

Diamonds.—Following a dispute with the Diamond Sales Corporation, all diamond sales were suspended by the Williamson Diamond Co., during 1950 and 1951. Production, however, continued, and in February, 1952, sales of stocks and current output were resumed, and during the year the export figures steadily rose, finally reaching the highest in the country's record.

The total sales include output by the Tanganyika Diamonds and Gold Development Co. Ltd. from their Alamasi Mine which has continued production steadily.

Lead.—Next to diamonds, the most outstanding mining achievement was the output of lead concentrates from the Mpanda Mine of Uruwira Minerals Ltd. This was higher by nearly 1,000 tons than last year's output, and the value of the concentrates exported was just short of £500,000—a valuable contribution to the country's revenue. The future of the mine is assured by the continued development results which have proved a very substantial ore reserve averaging 3.8 per cent lead with varying quantities of gold, silver and copper. Mill capacity is to be increased from 1,000 to 1,500 tons of ore a day.

Gold.—There were no new gold developments of any importance, and the output recorded comes mainly from the old established mines, viz., Geita G.M. Co. (Kentan Gold Areas) near Mwanza, New Saza Mines in the Lupa district, the Buhamba Mines at Musoma and East African Concessions, with reduced outputs from small workers.

The arrangement allowing producers to sell 40 per cent of their output on the free market was instrumental in maintaining the value of gold sold despite the drop in output, but it has failed to encourage extensive prospecting. Established companies, however, in spite of rising costs, have instituted exploratory development programmes.

Silver.—Since most of the gold deposits being worked contain silver, this metal is virtually a by-product of nearly all gold producers, and output consequently tends to move

with the gold output. The value of silver exported maintained its value at a little over £10,000 in 1952.

Mica.—This mineral is an old and well-established revenue earner and production, mostly from the Morogoro district, was fully up to previous figures. Besides an increased tonnage of sheet mica, a small output of ground and waste mica was recorded, and the total value exported was over £140,000, which is about £20,000 higher than the previous year's value.

Tin & Tungsten.—There was a marked drop in the output of tin during the year and also a smaller decrease in the production of tungsten concentrates. Consequently, the respective export values of these minerals were down to about £47,000 and £45,000.

Some prospecting activity continues especially in the Bukoba District south of the Uganda tin-bearing country.

Kaolin.—A small output of this mineral is reported from the plant erected last year by the New Consolidated Gold Fields at Pugu where extensive deposits have been developed.

Corundum & Gypsum.—These two minerals are newcomers in the export field, although corundum was worked in the Central Province during the war years when the Government manufactured hones for knife-sharpening. Gypsum has not been exported previously, although it is widely distributed in many parts of the country.

Other Minerals.—Work in many parts of the Territory has been carried out, investigating occurrences of kyanite, asbestos, magnesite, vermiculite and graphite.

Exploration & Development.—Work on the coal and iron deposits in the Songea and Njombe districts by the Colonial Development Corporation continued, and already

large reserves of workable coal have been proved by diamond drilling.

In the development of both the coal measures and the iron ore deposits at Liganga, distant about 35 miles, the question of rail links is under consideration. The benefits to be gained by the whole of East Africa from these developments will only come in the future as communications are completed and the deposits opened up for exploitation.

Prospecting.—Individual prospectors continue to explore the accessible parts of the country but more important is the work of large mining companies who are showing interest in the possible existence of nickel ore bodies and other minerals in the Western and Southern Provinces.

Kenya

Except for gold, mineral production showed a definite improvement with several new minerals figuring on a recovery list which is valued at over £1,750,000 sterling.

Gold. (Copper, Lead and Zinc.)—There was a drop of some 4,200 oz. in gold recovery during the year, and despite the sale of 40 per cent of output on the free market, the total value of production also dropped to £134,500 as against £235,000 last year.

Included above are copper, lead and zinc, because these minerals are associated with the gold ores from the old

MINERAL PRODUCTION IN 1952

Tanganyika*

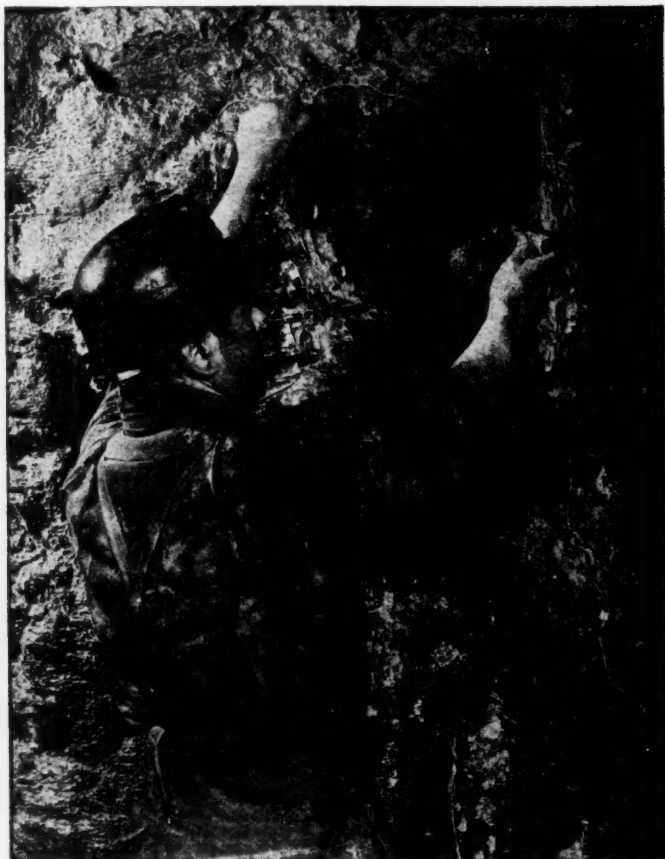
	1951	1952
Diamonds..... carats	8,595	331,643
Gold..... oz.	129,439	64,693
Kaolin..... tonnes	47	164
Lead conc..... tons	2,965	4,837
Mica sheet..... tons	70	109
Salt..... tonnes	3,870	4,483
Silver†..... oz.	33,500	35,900
Tin conc..... tons	92	63
Tungsten..... tons	39	36
*Minerals produced for export only.		
†Excluding silver exported in lead conc.		

Kenya

Diatomite..... tons	4,200	5,933
Gold bullion..... oz.	19,000	14,800
Gypsum..... tons	82	1,593
Kyanite..... tons	2,500	7,975
Salt..... tons	19,084	14,835
Soda Ash..... tons	N.A.	118,371

Uganda

Bismuth..... cwt.	56	80
Columbite..... tons	19	4
Galena..... tons	12	2
Gold..... oz.	223	201
Rock phosphates..... tons	2,207	4,931
Tin conc..... tons	162	154
Wolfram conc..... tons	144	132



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Macalder Mine which is now being worked by the Colonial Development Corporation under the name of Macalder-Nyanza Mines Ltd. The initial output from this mine consists of copper and zinc concentrates. Small quantities of pyrites are also recovered, and later gold, lead and possibly cobalt will also be produced.

Diamond drilling development continues and plans for a hydro-electric scheme are being considered to satisfy the power requirements of what promises to be a large and important producing mine.

Geological investigation of the commercial value of other pyrites lodes for exploitation for local use is being carried out in the Kakamega and other localities.

Except for the proved extension of the Kibigori gold reef (near Kisumu) for some considerable distance along the strike, no new developments of any importance have been reported.

Mineral Salts.—The exploitation of Lake Magadi by the Magadi Soda Co. continues to be the most valuable revenue earning industry in the Colony. Because of the extreme value of this occurrence, considerable geological study has been made of the Lake and the surrounding areas.

Kyanite.—The two main producers of this mineral, Kenya Kyanite Ltd., and East Africa Minerals Ltd., have together produced raw kyanite to the value of nearly £5,000 in 1952, while the former company have continued the production of the calcined product (mullite) to the value of £186,875.

Diatomite.—The production of this secondary mineral is increasing steadily. Output in 1952 was up by over 1,700 tons, at a value almost double that produced last year. The bulk of this production comes from the Kariandus deposit near Gilgil, although there are other deposits in the Great Rift Valley.

Gypsum.—This is a new mineral in the revenue earning field which may figure regularly in the future, since it is known to occur in several localities. Like so many of the low-priced secondary minerals, however, development has been handicapped by high transport costs.

Asbestos & Other Secondary Minerals.—The production of anthophyllite asbestos continues both for local use and export. Output is likely to show a steady increase with the development of a new undertaking known as the Makinyambu Asbestos Co. Ltd., operating deposits in the Teita Hills near Voi.

The work of the Geological Survey is encouraging exploratory prospecting and the opening up of occurrences of graphite, magnesite and mica. Occurrences of bentonite and vermiculite are also being investigated.

In the northern provinces indications of chromite bearing pyro-xenites have been investigated.

In general there is no doubt that with more settled political conditions and better and cheaper freight facilities, financial houses will be encouraged to follow up the initial work of the Geological Survey by geophysical surveys and diamond drilling exploration.

Uganda

Last year's review of mining development is already bearing fruit and although it must take time for big undertakings to reach a production stage, it is certain that this country will ultimately take an important place in mineral production in the Commonwealth.

Although export production showed a slight drop in value on last year's figure, the overall picture is one of intense activity in new enterprises and large scale development in many fields.

Gold.—Production of the precious metal would appear to be a dwindling asset, but as is common everywhere, the

drop in production is doubtless due to high costs which have crippled most small producers and has not encouraged prospecting or the development of new mines.

Wolfram.—This mineral takes pride of place as the highest revenue earner in the country, and although output was slightly lower than in 1951, the future of wolfram is assured.

The extensive development of the mineral belt in the Kegezi district and the auxiliary work incidental to installing machinery is directed by several large undertakings. The increasing recovery resulting from this work is assured of a steady market by the arrangement come to between the Government and the United Kingdom Ministry of Materials, for the purchase of all wolfram concentrates produced.

The importance of this field is reflected in the interest being taken by mining concerns, such as Rosterman Gold Mines, who have formed a new company (The Kabale Mining Co.) to work wolfram deposits and explore new areas. Other important companies in this field are the Bjordals Mines Ltd., Kirwa Wolfram Mines, Luhiza Mines, the Bahati and Mporora Mines. Besides these there are many small workers.

Tin.—This metal constitutes the oldest of the country's base metal industries and the main output still comes from the older mines, the best known being Kagera Tin. The value of cassiterite exported was slightly lower than in 1951, but with increased activity both by the bigger concerns and small workers, output is likely to grow steadily in the future. Besides the work in the Kagera area, more extensive developments are in train further south where the British Colonial Development Corporation is exploring and developing the Murongo Mine on the Uganda-Tanganyika border, and in the same area the Straits Trading Co. of Singapore is opening up its Kyerwa Syndicate for production.

Rock Phosphates.—This is a new mineral on the export list, and is likely to be the forerunner of a most valuable industry which will ultimately include the production of superphosphate and phosphorous fertilizers. This industry will eventually combine with the recovery of apatite from the Sukulu soils and the completion of the hydro-electric power plant at the Owen Falls.

Tororo Exploration.—The work of the Tororo Exploration Co. Ltd., which was formed jointly by the Rio Tinto Co., Frobishers Ltd., and Monsanto Chemicals with the Uganda Government for the development of the Sukulu eluvial ring deposit has now started. The initial step is the setting up of a pilot plant to test the separation of the minerals, magnetite, apatite and the several niobium and zirconium minerals which occur in the soil. This work will lead to the production of some of the most valuable rare earth minerals and later to the setting up of an important iron and steel industry.

Copper-Cobalt.—Another outstanding development is the opening up of the Kilembi Mine, situated on the eastern slopes of the Ruwenzori Mountains. From the ore reserves already proved, it is considered that this undertaking will rank as one of the big copper-cobalt producers in the world. For the operation of this concern, it has been arranged that the Uganda Electricity Board is to erect a transmission power line from the Owen Falls plant at a cost of £2,000,000. Production at Kilembi is estimated to start in 1955.

Secondary industries in Uganda are ahead of mining by the opening up of a cement factory erected by the Government at Tororo during the year, and this, with the completion of the Owen Falls hydro-electric plant, is but one indication of the future progress of industry in the Protectorate.

British West Africa

GREAT political changes are taking place in the West African Colonies and the business of government has largely been transferred to representative Africans. At the last annual general meeting of the shareholders of the Bank of British West Africa the Chairman, Lord Harlech, said that in the course of his recent tour of the West African Colonies he had met many of the Ministers of the new Governments and had been impressed by their keenness and goodwill; he added that there had been considerable expansion in the general economic situation of the Colonies during recent years, and that their steady growth was an important factor in the sterling area.

World demand for West African minerals continues firm and high prices are still being paid for most of them. West Africa is indeed fortunate in possessing natural wealth of a kind so much needed by so many countries overseas, wealth which scientific and technical skill are steadily turning to good advantage. The West African Colonies afford a striking example of the great efforts being made towards the development of natural resources, of the steady improvement of social amenities and of the considerable progress in education and interest in public affairs. Steps are being taken for the establishment of Colleges of Arts, Science and Technology at Ibadan, Zaria and Enugu. These Colleges will provide technical education at high professional levels, as well as for much-needed skilled artisans. Much capital will be required during the next few years if the Colonies are to proceed with the many development schemes in view.

Nigeria

The Nigerian Minister of Mines and Power, in a foreword to the recently issued Annual Report of the Geological Survey of Nigeria, states that the Nigerian public are becoming increasingly aware of the importance to the development of the country of its mineral and other underground natural resources, and stresses the great need for more Nigerians to make geology a career in order that they may take a larger part in the work of the Geological Survey Department. A mining geologist is stationed at Jos to furnish geological advice and assistance to the tin mining industry, while the office at Enugu, opened in 1948, acts as a centre for the examination of the coal, lignite, limestone, lead-zinc and other mineral resources of the eastern region.

A hydro-electric scheme is proposed at the Gurara Falls on the Gurara River.

During the year under review a preliminary report on the atomic and tantalite-niobate possibilities in Northern Nigeria was published by the Geological Survey of Great Britain. The report describes certain Nigerian pyrochlore-bearing granites which are a possible source of uranium and niobium with a possible by-product value in cryolite. Pyrochlore, a fluoniobate of sodium and calcium, is the essential radioactive mineral. Tests on the granites of the Kaffo Valley so far have failed to extract pure pyrochlore from the crushed granite, and a question now arising is whether separation by ordinary physical techniques to give satisfactory results can be attained. If these extraction difficulties can be overcome a large and important source

of uranium and niobium should become available within a British Colony, and it is hoped that the release of details of hitherto secret geological studies will stimulate interest in the subject by the mining industry.

The principal mineral exports for the year are shown in the table. Their value totalled £9,059,576 compared with £9,858,916 in 1951. In addition, the production of gold in 1952 amounted to 1,349 f.oz., valued at £14,458, as compared with 1,982 f.oz. valued at £21,628 for the previous year. Coal production amounted to 582,858 tons, valued at £972,502, as compared with 586,296 tons valued at £893,357 in 1951. Royalties paid to the Nigerian Government on mineral exports in 1952 amounted to £1,353,811. The labour force employed in the industry totalled 70,135.

Tin.—The production of tin last year was slightly lower than in 1951. The entire output is exported to the United Kingdom.

The gross price of tin concentrate fell by over £90 a ton as compared with last year, and mining costs over the same period rose by over £50 per ton. The increase in mining costs, due to the general inflationary conditions persisting in West Africa, together with the heavier royalty charges, taxation and Excess Profits Levy, is a matter of grave concern for tin producers, who are also faced with yet another increase in wages which has recently been agreed upon.

A decline in output is inevitable in view of the progressive exhaustion of the tin mining areas; and producers are already being obliged to work ground of steadily decreasing grade. It is imperative, therefore, that treatment plants work to maximum efficiency and that money be spent on their modernization.

The Financial Secretary's budget speech made last year in the Nigerian Constituent Assembly noted that the present scale of royalties had become unrealistic within the lower and middle-price brackets, and would, if the price of tin fell very much further, inflict inequities on tin producers and damage to the Nigerian tin industry. It may therefore, he added, be necessary for the Government to re-examine the scale of royalties in the light of the changes in the cost of production of tin and the prices of the metal during the past year.

Columbite.—The price received for columbite has risen sharply under the pressure of U.S. bidding from £845 to about £2,070 per ton of concentrate for 65 per cent grade and this has caused considerable activity among Nigerian producers, who are planning increased production. One company—Gold and Base Metal Mines of Nigeria—having recently acquired certain options and columbite deposits in the Liruie-n-Kano district of Northern Nigeria, expect to treble their output. The company hopes to raise its production to over 670 tons of tin and over 80 tons of columbite this year and to over 750 tons of tin and over 150 tons of columbite in 1955-56; in 1952 their production was 570 tons of tin and 26 tons of columbite. A contract has been made for the sale of this columbite production until the end of 1953. Extraction up to the present has largely been carried out by hand labour working with limited water supplies. The newly acquired deposits, being all alluvial, will be

MINERAL EXPORTS IN 1952

Nigeria		1951	1952
Tin	tons	11,753	10,575
Columbite	tons	1,092	1,228
Wolfram	tons	19	47½
Other ores: (lead, tantalite, zinc) tons		79	170
Gold Coast			
Diamonds	ct.	1,712,033	2,051,496
Gold	f.oz.	692,301	711,096
Silver	oz.	52,542	44,116
Manganese	tons	806,080	794,192
Bauxite	tons	129,328	74,368
Other metallic ores	tons	111	37
Sierra Leone			
Iron-ore	tons	1,140,325	1,152,495
Gold	f.oz.	3,151	2,591
Chromite	tons	16,165	22,490

exploited by monitors, gravel pumps and sluicing; arrangements have already been made for a large water conservancy scheme.

As the United States Government is paying a 100 per cent bonus on all columbite shipments to the United States, this mineral has become a very valuable commodity commanding a high price, and producers will clearly be encouraged to take every possible step to recover the appreciable quantities still remaining in areas previously worked for tin. Most of the columbite is recovered from the large tin deposits of the Plateau, though considerable quantities are also obtained from the Kano and Bauchi Provinces.

Lead/Zinc.—During the past three years considerable sums have been expended by the American Smelting & Refining Co. on the examination and testing of the Abakaliki lead-zinc deposits in the Ogoja and Benue Provinces. The existence of payable ore bodies had been established and licence and lease terms agreed with the Nigerian Government, as well as scales of royalty payable on production of the ore. Notice has, however, recently been given to Mines Development Syndicate (West Africa), owners of the leases, by the American Smelting & Refining Co. that they do not intend to continue their option over the properties.

Oil.—The search for oil in the southern part of the Colony, commenced by the Anglo-Iranian and Shell companies and interrupted by the war, has recently been resumed and drilling started. The borehole which is being sunk at Ihuo, near Owerri, has reached a depth of over 9,000 ft.

Limestone and Cement.—Fifteen bodies of limestone, varying in thickness from 1 ft. to 29 ft., have been recorded in boreholes at Nkalagu, about 20 miles east of the Udi coalfield. Chemical analyses of the cores indicate that the limestones and shales are suitable for the manufacture of cement, and the drilling has confirmed that sufficient quantities are available for a large cement plant.

Gold Coast

Far-reaching development schemes are in progress in the Gold Coast, chief among them being the vast Volta River aluminium project. In November the Government published a White Paper outlining the scheme, under which the United Kingdom Government, the Gold Coast Government, and Canadian and United Kingdom aluminium producers would develop large scale aluminium production in the Colony. The project envisages the creation of a new source of hydro-electric power by the damming of the 1,000 mile long Volta River, which crosses the country from north-west to south-east, and the development of the Colony's mineral wealth, more especially its enormous bauxite deposits. The successful completion of the scheme would guarantee United Kingdom industry additional sterling area supplies of aluminium at competitive prices. The scheme, probably the largest Colonial development ever undertaken, aims at an ultimate aluminium output of 210,000 tons a year; its estimated cost is over £100,000,000. The potentialities of the project are enormous and should in time bring about vast changes in the economy of the country.

Apart from the manufacture of aluminium the provision of practically unlimited electric power should attract many other new industries whose activities would be limited solely by the amount of labour available. Complementary to the scheme is the construction of a harbour at Tema, to the east of Accra, with which will be provided connections with the existing railway network of the Colony. Fuller

details of the scheme were published in *The Mining Journal* of December 5, 1952.

During the past year good progress was made on the Takoradi Harbour extension though much work still remains to be done.

Exports for the year of the Colony's principal minerals—diamonds, gold, manganese and bauxite—each of which commands a ready market overseas, are shown in the table. Their value totalled £23,243,399 compared with £22,034,648 in 1951. The mining industry is, without doubt, largely responsible for the prosperity and welfare of the Colony and it should be given every encouragement for its further development.

Gold.—Commencing on May 1, 1952, the Gold Coast Government authorized the mines to sell the whole of their production of gold on the "free" market. The "free" market price to-day represents additional revenue to producers of about 20s. per oz., and helps to off-set the increased cost of wages, consumable stores, etc.

Together with the excellent results recently announced by some of the gold producers there is a growing confidence in the political stability of the Colony and evidence of improved co-operation between Africans and Europeans. The mining industry as a whole negotiated a settlement which involved an increase of about 20 per cent on wages as from April 1, 1952. The effect of this on the Colony's largest gold producer will exceed £80,000 a year.

The Colony's gold output for the year totalled 691,459 f.oz. compared with about 699,000 f.oz. in 1951. An account of the work of the principal producing mines during 1952 will be found on pages 216 to 219.

Diamonds.—Gold Coast production of diamonds, begun in 1920, has reached to date a total of about 20,000,000 ct. The deposits of the Birim River district, 60 to 80 miles north-west of Accra, are operated by four European companies. The deposits of the Bonsa diamond field are too erratic for profitable exploitation by large scale mechanical methods and are, consequently, worked only by Africans. All of the known occurrences in this region are alluvial, the richest areas occurring in or near the present stream beds. The general diamond content varies between 1.6 and 1.9 ct. per cu. yd., and the output averages about 85 per cent industrial stones. The diamonds are small in size, the largest so far recovered weighing about 4½ ct. Exports in 1952 amounted to the record figure of 2,051,496 ct., valued at £5,547,027. The average value of diamonds in 1952 was lower than in 1951, due mainly to lower world prices for industrial diamonds, which are an important part of Gold Coast output.

The accounts of the principal producer, Consolidated African Selection Trust, Ltd. and its subsidiaries for the year to June 30, 1952, show that the combined profit, before tax, was £2,192,797. This indicates a contraction of £504,625 on the previous year's figure and resulted in a reduction of the dividend to 80 per cent, as compared with 100 per cent for the previous year. Profit on the Gold Coast production after charging working expenses was approximately £900,000. This figure was reduced to £180,000 after payment of £200,000 in respect of export and mineral duties and concession royalties and taxation amounting to £520,000.

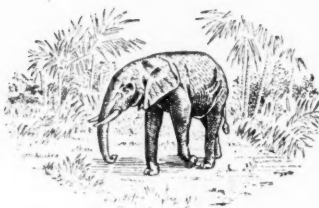
Exports of diamonds by African diggers amounted to 70 per cent of the total, nearly double the 1951 figure, whereas the output of the organized mining companies was lower by 25 per cent. In conjunction with this African production illicit diamond mining continues as a serious threat to the company. There is no doubt that substantial quantities of diamonds continue to be removed illegally from the Trust's concession areas. These areas

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cover nearly 70 sq. miles of thickly wooded country, and as Africans have been permitted to take out digger licences on the borders of the company's main operating zone the difficulty of preventing illicit mining and theft is obvious. The prices at which the company's production of industrial and gem stones has been sold have substantially improved during the past year. Notwithstanding the ever-increasing burdens of taxation and of the labour and operational costs which have to be met the company considers that the outlook for the current year's trading is again satisfactory.

Manganese.—Whereas the Gold Coast produces only about 3 per cent of the world's gold, its output of manganese ore is estimated to amount to over a quarter of the world's total measured in terms of the manganese content of high grade ore containing 45 to 47 per cent or more of manganese. The principal consumers of Gold Coast ore are the steel industries of the United States, the United Kingdom and Norway. About one-eighth of the ore produced is of a high grade quality used in the manufacture of batteries and in certain chemical processes. There was little change in the amount of manganese produced in 1952 compared with the previous year, but there was an increase in value of about 14 per cent. Practically the whole of the output came from the deposits at Nsuta, in the Tarkwa district, owned by The African Manganese Co., employing over 5,000 workers, including about 50 non-Africans.

Bauxite.—Exports of bauxite in 1952 at 74,368 tons showed a decrease as compared with the previous year, though the labour force was slightly higher. The authors of the Paley report on aluminium estimate that the bauxite resources of the Gold Coast amount to 230,000,000 tons of an average alumina content of 53 per cent, yielding a total of 51,000,000 tons of the metal.

Sierra Leone

As in the other West African Colonies several plans exist for the further development of Sierra Leone. Just completed is Freetown's first deep-water quay, enabling more expeditious handling of cargoes than has been the case hitherto. The projected hydro-electric and water supply schemes are being pressed forward and a site for a dam in the Guma valley has been chosen.

Whilst not the mainstay of the country's economy the mining industry, young though it is, is making an important contribution to it, and in the past year was responsible for nearly 50 per cent of the Colony's total exports by value. When it is remembered that prior to 1926 no mineral deposits of commercial importance had been found and no minerals whatever exported from Sierra Leone this achievement can be regarded as remarkable.

The discoveries of the deposits of diamonds, gold, platinum, iron-ore and chromite made by the Government geologists in the years 1926 to 1930 have proved of the utmost value and importance to the economy of the country, and a well-known authority on the geology of the Colony has recently stated that there is still considerable scope for the discovery of further important mineral deposits. Of the known undeveloped occurrences, the Tonkolili iron ores, which constitute one of the largest reserves of favourably situated high-grade iron ore in the world, are of outstanding importance. They have been traced continuously for more than five miles over great widths. According to the Annual Report of the Sierra Leone Geological Survey and Mines Department for 1930-31 one hill alone contains more than 70,000,000 tons of easily won good grade ore.

The labour force employed in the mining industry in 1952 was 7,704, an increase of 663 over the previous year.

Diamonds.—Exclusive rights to produce diamonds in the Colony are held by the Sierra Leone Selection Trust, a wholly owned subsidiary of Consolidated African Selection Trust. The deposits all lie within the Bafi-Sewa River drainage system. At present mining is confined to the Yengema-Sefadu area. However, a separate diamond field has been prospected that is related to an old high level terrace of the Moa River. There appears to be no connection between the deposits of the Sewa and Moa River systems, but the Moa River deposits in Sierra Leone are related to those found in the neighbourhood of the major headwater of the Moa in French West Africa.

The headquarters of the Sierra Leone mining field is at Yengema. There are seven electrically operated pan concentrating plants in operation. Two plants at Koidu have a combined capacity of 330 to 360 cu. yd. per day for treating the rich gravels of the Woyie River. In these deposits some remarkably rich areas have been worked, yielding values up to 250 ct. to the cu. yd. A number of exceptionally large diamonds have been found, including stones of 294, 532 and 770 ct.

Production for the year ended December 31, 1952, was 452,618 ct. For the previous year the figure was 474,821 ct., of which 34 per cent were gem quality and 66 per cent were industrials. Total production to December 31, 1952, has been approximately 11,425,000 ct.

For the year ended June 30, 1952, the operating company reported a sharp fall both in the quantity and value of their production, resulting, as compared with the previous year, in a reduction in net revenues after deducting operating expenses of about £670,000, i.e., from £2,100,000 to £1,430,000. As in the case of the Gold Coast, illicit mining and theft have become a problem, and energetic steps are being taken to deal with it.

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The United States

By Our Own Correspondent

JANUARY, 1953, saw the Republican Party in control of the Government for the first time in twenty years. During those years, Government has asserted increasing control over business to an extent that was generally felt to be hampering development and expansion. The Republicans promised that these restrictions would be relieved wherever practicable and the new administration lost no time after Mr. Eisenhower's inauguration as President in putting some of the changes into effect. In fact there is a feeling in some quarters that practice in this respect may be too drastic but at this writing sufficient time has not elapsed to determine just what the final reaction will be. Business in general is favourably inclined toward the present administration and is hopeful that it will be more businesslike and economical than previous administrations have been.

Aside from the elections, the outstanding event of the year, and undoubtedly the most controversial, was the publication of the report of the President's Materials Policy Commission under the somewhat grandiose title of "Resources for Freedom" and commonly known as The Paley Report, from the chairman, Mr. William S. Paley.

In "Notes and Comments" *The Mining Journal* of January 2, 1953, discussing the report aptly comments, "which its authors would have us accept as an apocalyptic vision of things to come," and "it is obvious that in the mining and metal interests there are authoritative sceptics of the validity of its conclusions." While all five members of the commission were outstanding in their respective lines only one was actively engaged in mining, one had graduated from a mining college but has long ceased to follow the profession and the others were a broadcasting executive, an educator and an editor. These men predicted supply and demand of the various metals over the next 25 years and presented graphs which told us in just what year demand for a certain metal would surpass supply and how much of any metal we would be importing in 1975. Considering the source it is not surprising that "there are authoritative sceptics."

The following estimates are prepared before official statistics are available for 1952. They are compiled from the most authoritative information at hand and are believed to be accurate within the allowable limits of statistical error.

Gold

Gold mining largely "coasted" during 1952. Inflationary costs, the fixed price and the fact that none of the mines has fully recovered from the effects of the wartime order, which arbitrarily shut down the entire industry, tended to restrict production. Following the war there was a slight annual increase until 1950 when output reached 2,300,000 f.oz. Output in 1951 fell off about one-sixth to 1,900,000 f.oz. and 1952 is estimated at about 1,653,000 f.oz.

Several gold mine operators filed claims against the United States for damages alleged to have been inflicted by the wartime closing order. The Government resisted the hearing of these actions but the Court of Claims ruled in favour of the operators and at the time of writing

hearings are in progress. In its campaign the Republican Party advocated some relief for the gold industry and bills toward that end have already been introduced in Congress but are probably premature at this time.

Silver

1952 showed little change in production of silver, almost all of which is recovered as a byproduct of copper, lead and zinc. Output is estimated at 39,069,000 f.oz., as compared with 40,000,000 in 1951. Under present laws all silver is purchased by the Government at 90¢, which policy has been attacked frequently in Congress but on which the opposition was silent during 1952. Both parties ignored silver during the political campaign but it is significant that all of the laws fixing the price were enacted under Democratic auspices and some of President Eisenhower's close advisers are men identified with the silver users, notably Under-Secretary of the Treasury Folsom of the Eastman Kodak Co., probably the largest user of commercial silver in the country. Repeal of the purchase act would be consistent with the policy of the new administration to remove controls and let prices seek their own levels.

Copper

The price situation during the year has been very confusing. After the Chilean Government terminated its agreement to sell copper in the U.S. at 27¢, American importers were allowed to bring the metal from abroad at whatever price they might negotiate, which was mostly 36¢, while ceiling price on domestic copper was held at 24¢, despite many pleas by producers to raise or remove it. In line with its policy the new administration abolished controls on February 25, 1953, and the next day the price advanced 3¢. Suspension of the duty of 2¢. per lb. was extended from February 15, 1953, to June 30, 1954. Production from domestic mines during the year is estimated at 924,470 s.tons during 1952, just 4,000 tons less than in the preceding year. The increase in production expected at the beginning of the year did not materialize but it is expected that with control removed the price will seek a higher level and production will be stimulated during 1953.

Lead

Lead had a hectic year with many ups and downs in price which varied from 19¢. at the opening of the year to a low of 14 in October, closing the year at 14½. As a natural result of this lower price, many mines closed down although the effect on output from domestic ores was not as great as expected, production for the year being 384,100 s.tons, less than one per cent below 1951. As usual, the greatest consumption was for storage batteries with tetraethyl and cable covering next.

Zinc

Zinc suffered with lead from a decline in price. The year opened with zinc at 19½¢, which price was maintained for five months and then declined steadily to 12½¢. for the last two months. While this resulted in the closing of many mines, as in the case of lead, the overall effect on the year's

PRODUCTION OF SOME METALS*

	1950	1951	1952
Gold000,000 f.oz.	2.30	1.90	1.65
Silver.....000,000 f.oz.	42.50	40.00	39.07
Copper000 s.tons	909.34	928.33	924.47
Lead000 s.tons	430.83	388.14	384.10
Zinc000 s.tons	623.38	681.19	661.02
Molybd'm...000 s.tons content	15.00	19.50	22.50
Tungsten ...000 s.tons content	1.98	2.96	3.39
Chromite000 s.tons	0.40	7.06	20.00
Manganese (30+%) 000 s.tons	134.50	94.80	110.00

*Does not include Alaska.

production was not as great as had been expected. Estimated mine production for 1952 is 661,000 tons, off three per cent from 1951. Approximately 95,000 to 100,000 tons went for oxide, sulphate and lithopone and the remainder to the smelters. Because of the protracted steel strike consumption for galvanizing fell off perceptibly but as usual this industry and die casting supplied the greater part of the demand.

Ferro-Alloys

With the exception of molybdenum, of which Climax is by far the world's largest producer, the United States is dependent on imports for the greater part of its ferro-alloy metals.

Molybdenum.—Climax increased its output during the year by driving new mine workings and enlarging its concentrator. Other production came from California and the disseminated coppers of Arizona, Nevada, New Mexico and Utah. Records of production for the year are incomplete but on the basis of available data it is estimated at 22,500 s.tons of molybdenum contained in concentrates.

Chromite.—Chromite production was stimulated during the year by the Government providing purchasing facilities. Output is estimated at 20,000 s.tons, a marked increase over previous years. Deposits of commercial quality are limited and widely scattered but there are very large reserves of low grade, particularly in Montana, on which research has been carried on over a long period and the Government has made a contract with one large company for a supply of 900,000 tons of concentrates, 38 per cent Cr_2O_3 or better, over a period of eight years.

Tungsten.—Production is from a number of scattered deposits, many of them quite small. Considerable plant construction was undertaken in 1952 although in many instances the results will not be apparent until the present year. Production is estimated at 3,395 s.tons of metal, the equivalent of 7,132 s.tons of 60 per cent WO_3 concentrates.

Manganese.—Production of manganese ore of 30 per cent grade or better is estimated at 110,000 s.tons, practically all from Montana. Production of iron-manganese ores from the iron ore districts, principally Minnesota, is approximately 1,000,000 tons. There are throughout the country large deposits of low grade ore which have been subjected to much research for a suitable treatment process. This problem is now at least partially solved, one large plant commenced operation recently and another will be on production in the near future.

Uranium

Due to stimulation by the Government over the past five years the United States now ranks second only to the Belgian Congo as a uranium producer and the Colorado Plateau region is considered second in uranium resources. More than 5,000 men are now employed in this area, eight mills are now operating and another is under construction. In Florida, uranium is being produced as a by-product in the treatment of phosphate rock. Naturally no details as to production are available.

Promising Outlook for 1953

The above is an attempt to sum up briefly the situation as of 1952. Many subjects of importance have not been touched at all. Mention might be made that Howe Sound is now producing cobalt at its Utah plant and National Lead will be producing nickel and cobalt from Missouri ores in 1953. M. A. Hanna Co. is about to commence construction of a plant to treat a large deposit of nickel silicate ore in Oregon.

Viewing 1952 as a whole we do not see any great expansion of output over the preceding year but, considering the setbacks that occurred and the general outlook at this writing, it is believed that 1953 will present a better showing.

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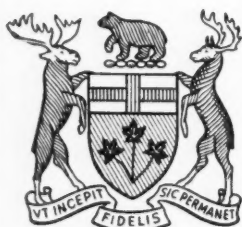
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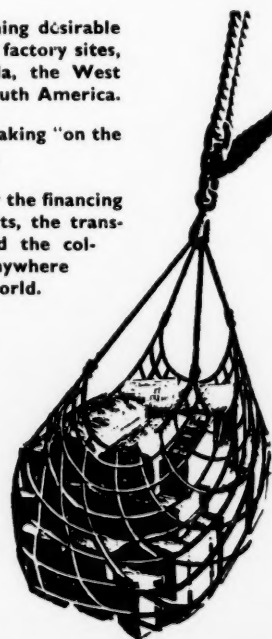
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Canada

By Our Own Correspondent

NOT only did the mineral industry of Canada yield a record harvest of \$1,278,000,000 during 1952, but the year was marked by a broad increase in the scope of mining activity and new mineral discoveries. While expansion was taking place throughout the year in the established areas of production, new discoveries and new developments were taking place in sections which heretofore lay dormant; as in the case of the discovery of a second new iron range on the far northern tip of Quebec near Hudson Straits, the large new deposits of lead and zinc in New Brunswick, the new asbestos areas in Northern Ontario, the nickel deposits of northern Saskatchewan, the rising tide of new petroleum wells in Alberta, and the rising activity in British Columbia and the Yukon Territory.

Gold, Nickel & Copper

In point of value produced in dollars, gold, nickel and copper were close rivals with gold and nickel closing the year in a photo finish. Gold produced had a value of \$151,450,000. Nickel output had a value of \$151,000,000. The production of copper had a value of \$147,850,000.

As a result of the price of nickel having recently advanced, and with new production soon to begin from northern Manitoba to augment the expansion taking place at Sudbury, in Northern Ontario, there are prospects of the annual yield of nickel taking on greater value than that of gold unless the price of gold is to be increased.

Mining Predominance of Ontario

The province of Ontario maintained a leading place among the ten provinces which make up Canada. Ontario's mineral output for 1952 had a value of \$438,500,000, or more than 34 per cent of the nation's mineral yield. Over 36 per cent of the mineral output of Canada came from the areas west of Ontario, including the combined production of Manitoba, Saskatchewan, Alberta, British Columbia, the Yukon Territory and the North-west Territories. The remainder, or upwards of 39 per cent came from the areas east of Ontario, including Quebec, Nova Scotia, Newfoundland, New Brunswick, and Prince Edward Island. The province of Quebec alone accounted for \$267,200,000, thereby holding second place among the provinces; Alberta occupied third position with an output of \$197,300,000, closely followed by British Columbia with \$172,900,000.

Exercising a potent influence in the growth of the mineral industry in Canada is the extent to which the great rivers of the country are being harnessed. More than 14,000,000 horsepower has so far been developed along these rivers—approximately one horsepower for each man, woman and

child in the nation. Still awaiting development is a further 30,000,000 horsepower at least, thus offering scope for harnessing further electrical energy in keeping with the growth of population for possibly the balance of the current century.

Strong Capital Inflow

Another important influence on the mining and general industrial growth of Canada is the extent of capital flowing into the country from other lands, more particularly from the United States. To adventurers and capital alike there is lure in the direction of new lands which yield in growing abundance such things as iron, petroleum, nickel, gold, copper, zinc, lead, asbestos, cobalt, aluminium, together with promise of uranium in quantities which may soon challenge world leadership—a matter of vast significance in this opening stage in the new era of atomic energy, with all its potentialities.

Perhaps youth should not boast, but a youngster such as Canada among the nations might reasonably be excused for pointing to records achieved and being maintained: the largest producer of nickel in the world; the largest producer of asbestos in the world; the world's largest producer of platinum; the world's second largest producer of gold; the second largest producer of zinc; the second largest producer of aluminium; and the second largest producer of cadmium. The world's third largest producer of silver, and the world's fourth largest producer of copper, lead and cobalt. Add to these records the developments now occurring in the petroleum areas of the western provinces, and the iron ranges of Ontario, Quebec and Labrador. Also add to this the developments in the uranium fields of northern Saskatchewan and the North-west Territories. The total sum of achievement has become impressive—and becomes increasingly so when it is remembered that there still remains a virgin area much greater in extent than that so far developed.

Indicated Increase of Output

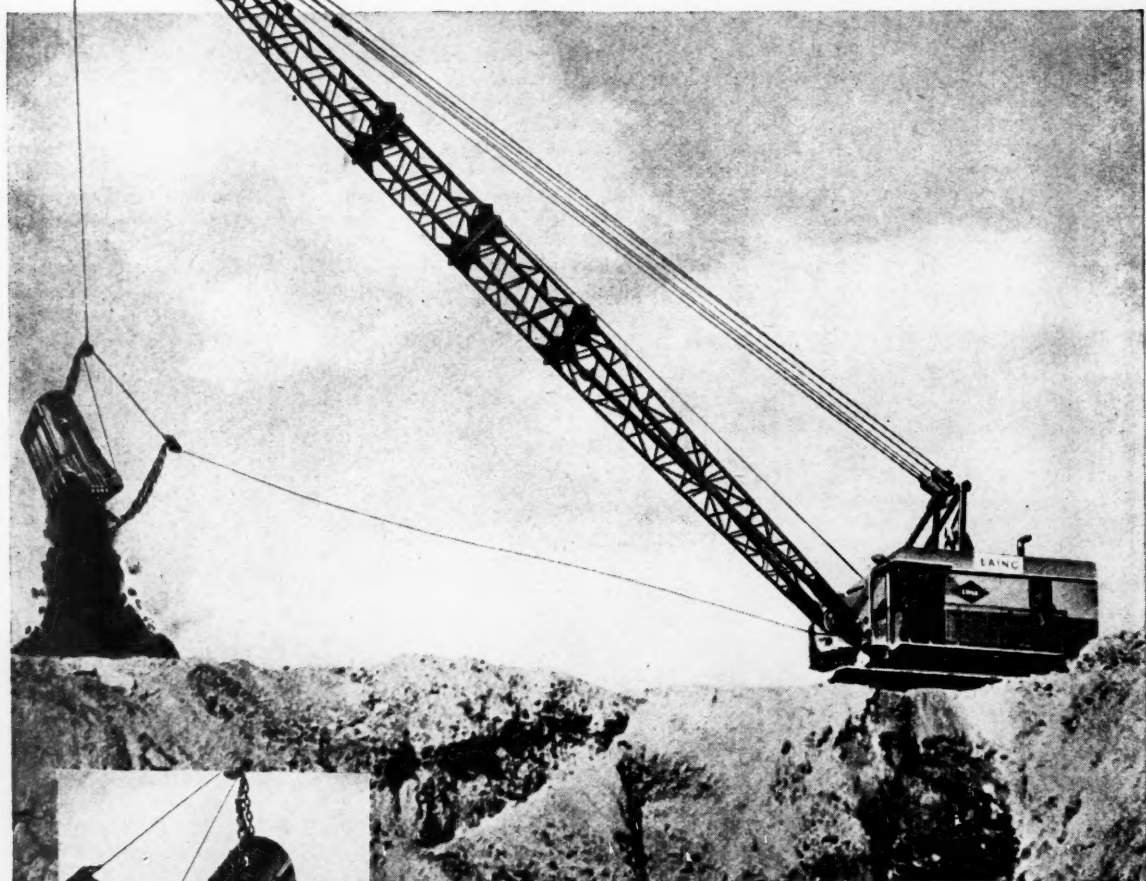
Adding force and impetus to the growth of the mining industry at this time is science and research. Instruments, in low flying planes, now move across the skies at greater than express train speed, and the keen eyes of scientific prospectors read messages conveyed to them on the dials of their scientific instruments of resources hidden beneath the surface of the earth.

Throughout Canada's history, up to the end of 1952, the country produced approximately \$17,000,000,000 in mineral. The indications are that in the next ten years, the output will exceed the total mineral production for all time prior to 1953. That in itself illustrates the momentum established.

METAL AND MINERAL PRODUCTION

	1950 (000's)	1951 (000's)	1952 (000's)
Antimonylb.	644	1,200	2,500
Asbestoston	875	967	966
Arsenious Oxide lb.	794	2,404	1,530
Bariteton	77	98	119
Bismuthlb.	192	234	180
Cadmiumlb.	848	1,211	1,005
Coalton	19,139	18,750	17,360
Cobaltlb.	584	947	1,303
Copperlb.	528,418	540,967	515,413
Fluorsparton	64	74	83
Goldf.oz.	4,441	4,329	4,420
Iron Oreton	3,605	4,736	5,205
Leadlb.	331,394	304,999	329,759
Micalb.	3,879	4,962	1,991
Molybdenite (MoS ₂)lb.	104	350	498
Nickellb.	247,318	274,536	280,013
Palladium, rhodium, etc.f.oz.	149	162	150
Petroleumbbl.	29,044	48,097	60,864
Platinumf.oz.	125	155	120
Seleniumlb.	262	369	266
Silverf.oz.	23,221	24,245	24,376
Sulphurton	301	372	441
Telluriumlb.	10	68	14
Tinlb.	796	346	212
Titanium Dioxide ton	2	14	42
Tungsten (WO ₃) lb.	284	20	1,222
Zinclb.	626,455	667,872	764,113

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British Caribbean Territories

By A. GRAHAM THOMSON

THE highlight of the year in this part of the world was the production of alumina for the first time in Caribbean history, when a plant operated by Alumina Jamaica Ltd. (formerly Jamaica Bauxites Ltd.) a subsidiary of Alcan, came into operation in December, 1952. The initial output is 120 tons a day, but expansion to 450 tons is envisaged and the plant will eventually be the largest source of alumina in the sterling area.

Jamaica

Another notable event was the official opening of bauxite mining operations at Ocho Rios, Jamaica, by Reynolds Jamaica Mines Ltd., which took place early in 1952. Since June, 1952, the company has been shipping bauxite to the U.S. in a new type of ore-carrying ship equipped to unload the ore by means of its own inbuilt materials handling plant. Kaiser Bauxite Co., the Jamaican subsidiary of Kaiser Aluminium and Chemical Corporation, who are also shipping ore to the United States, stated that 19,000 acres of bauxite reserves acquired in Jamaica had an annual capacity of approximately 2,000,000 tons and were sufficient to supply Kaiser's extended operations for an estimated 50 years.

Manganese deposits in Jamaica have been prospected by the Geological Survey, but they appear to be rather small. A report by the Government Geologist, Mr. V. A. Zans, mentions 500 tons. The island's total gypsum reserves cannot be less than 84,000 tons. This mineral is being produced at a quarry owned by Bellrock Caribbean Ltd. Both crude gypsum and plasterboard are being exported, mainly for use in the Caribbean for building purposes.

A further impetus to the expansion of mining should result from a 10-year development programme for Jamaica, proposed in the report of a World Bank mission which visited the island early in 1952. This programme aims at increasing production of goods and services from the 1950 level of £85,000,000 to about £150,000,000 in 1962.

Trinidad

At the last meeting of the West Indies Conference, held recently in Jamaica, a resolution was passed which urged the need for further Geological Survey development of the Caribbean area in connection with industrial expansion. For example, the importance of oil to Trinidad is shown by the fact that this industry's direct contribution to the island's fiscal revenue has risen from \$(B.W.I.)2,846,282 (19.9 per cent of the total revenue) in 1939, to \$(B.W.I.)16,875,640 (30 per cent of the total revenue) in 1950. The Colonial Development Corporation are proposing to start a cement plant in Trinidad of about the same capacity as that in Jamaica.

Eleven companies are engaged in Trinidad's petroleum industry. Four companies operate shipping terminals and two—Trinidad Leaseholds Ltd. and United British Oilfields Ltd.—maintain refineries and purchase crude oil from other local manufacturers, besides producing it themselves. An increasing amount of foreign crude is being imported each year, the refined products being re-exported. A large part of the refinery output is disposed of to the local bunker trade and in shipments to the U.K. A small amount of crude is exported for refining to Canada. Vigorous drilling programmes are being carried out, but the results of recent exploration have been disappointing. Sufficient drilling has been done to maintain the Colony's crude production in the vicinity of 56,500 bbl. per day. There is also an annual production of some 120,000 tons of asphalt from the Lake of La Brea.

British Guiana

In British Guiana gold production is again increasing owing to the development of dredging. In 1952, there was a production of 24,223 f.oz. compared with 14,688 oz. the previous year. With financial assistance from the Colonial Development Corporation, British Guiana Consolidated Goldfields Ltd. completed a new dredge towards the end of 1951, and this is now operating at Tumatumara on the Potaro River with satisfactory results. Another new dredge will work on the Konawaruk River.

The production of diamonds declined from 43,260 metric ct. in 1951 to 38,304 metric ct. last year. The Kurupung Placers Co. with the assistance of E.C.A. finance carried out detailed prospecting in the alluvial deposits adjoining that and the Anaboring rivers during 1951 and 1952. There has also been considerable diamond mining activity near Kurashi Creek, a tributary of the Cuyuni.

Bauxite production in British Guiana totalled 2,087,079 l.tons in 1951. The Demerara Bauxite Co.—a subsidiary of Alcan—have increased their drying capacity to 2,225,000 tons of bauxite annually. The Berbice Bauxite Co., a former subsidiary of American Cyanamid—has transferred all its assets to the Reynolds Metals Co., but is continuing its operations on the Berbice River.

During 1952, trial shipments were made of columbite from the Mazaruni River area. It has been tentatively estimated that there are about 2,000,000 lb. of columbite in the eluvial occurrences of this district and there seems to be a definite prospect of some development.

In 1951, the Geological Survey discovered an extension of the manganese area which exists in the north-western part of the Colony. These occurrences are being investigated by the African Manganese Co.

Among the recommendations of the Paley Report was the development of hydro-electric power outside the United States. For some time Demerara Bauxite has been surveying a number of falls in British Guiana in order to obtain data in connection with hydro-electric proposals. Mr. Adrian J. van Staalen, a Dutch engineer and United Nations expert, is to study the possibility of furthering hydro-electric development.

A report by Dr. S. Bracewell on the Geological Survey of British Guiana in 1951 has been published.

British Honduras

For some two or three years the northern section of British Honduras has been under investigation by the Bahamas Exploration Co., a subsidiary of the Gulf Oil Co., who are looking for oil. Geological and geophysical exploration has been carried out, but as yet no results have been disclosed. Cassiterite occurrences have been explored, but show no indication of commercial occurrences.

In 1951, the Bahamas exported 48,321 l.tons of salt and the Leeward Islands 6,884 l.tons. In 1950 the Turks and Caicos Islands exported 60,000 l.tons. There is also some salt production on St. Kitts and small production mainly for local consumption in Grenada and other islands.

Since 1948, the Geological Staffs in the British Caribbean have been expanded with the assistance of grants from the Colonial Development and Welfare Fund. These grants provide for the employment of ten geologists in British Guiana, three in Jamaica, one in British Honduras, one in the Leeward Islands, and one in the Windward Islands.

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Argentina

By Our Own Correspondent

IT is becoming increasingly clear how excellent the Public Relations job was which President Perón has done during the last two years. During a period of "one crop failure and two half-failures" (in his own words) he has been able to maintain the morale of the people, in spite of shortages even in wheat and meat, a drastic drop in the masses' purchasing power, and a continued criticism of every one of the government's acts in the American Press. At the time of writing, tension is easing thanks to a bumper, but not at all a record, crop, and the expectation of improved relations with the new régime in Washington.

The Five Year Plan

While the figures for mining production have not been particularly impressive, Argentina has succeeded, in spite of the critical foreign exchange situation, in maintaining her fuel imports on a high level—as expressed in the satisfactory output of the oil refineries working to a very large extent on the basis of foreign crude. In other directions, besides, substantial improvements are in the offing. The second (1953/57) Five Year Plan is already under way and, while the first is now conceded to have been drawn up without sufficient preparation, the new one is the result of more serious studies. Its scope may be seen from the following comparison of production figures, passed and planned, expressed in thousands of tons:

	1947	1948	1949	1950	1951	1952 Jan./May (Target)	1957
Sulphur	10.9	8.4	10.0	7.8	7.7	10.3	40.0
Lead	35.5	33.6	27.8	32.3	35.7	13.6	52.0
Tin	0.2	0.3	0.1	0.1	0.1	0.1	2.0
Zinc	31.0	23.5	20.8	24.7	31.8	13.5	27.0

Production of sulphur, 99 per cent fine, will be developed in San Juan (Valle del Cura) and Neuquen; production

of lead concentrate (72 to 77 per cent) is scheduled to rise to 70,000 tons; tin will come from 17 deposits; production of zinc concentrates (50 to 52 per cent) will rise to 90,000 tons.

There are other items on the list of achievements-to-be. Aluminium and copper production are expected to amount to 10,000 and 14,000 tonnes by 1957, on the basis of close co-operation between the military factories and private industry; manganese production to 9,000 tonnes (260 per cent in terms of 1951); production of metallic silver to 52 tons (by 11 per cent); beryllium oxide to 350 tons (plus 75 per cent); mica to 600 tons (plus 50 per cent); wolfram to 5,000 tonnes (900 per cent). Coal production which rose from 18,000 tonnes in 1949 to almost 40,000 in 1951 and 37,000 in the first five months of 1952 is scheduled to reach 1,200,000 tons by 1957.

954,000,000 pesos will be invested in the development of iron ore deposits and the manufacture of rolled material including rails. According to the Second Five Year Plan the production of cast iron and steel is expected to reach at least 600,000 tonnes by 1957 as far as the General Directorate of Military Factories and the Siderurgica Mixta is concerned, while private production is expected to bridge the gap between this figure and the total needs.

How much of this ambitious programme will be carried out, is anybody's guess. However, it would be very wrong to ignore it. The Argentine Government will continue its drive towards industrialization; in addition, it invites foreign co-operation. It is ready to give foreign investors more solid guarantees for the transfer of profits than were granted in the past. It is also ready to do business with anybody, including the communist world—who can supply industrial raw materials, machinery and rolling stock in exchange for Argentine commodities.



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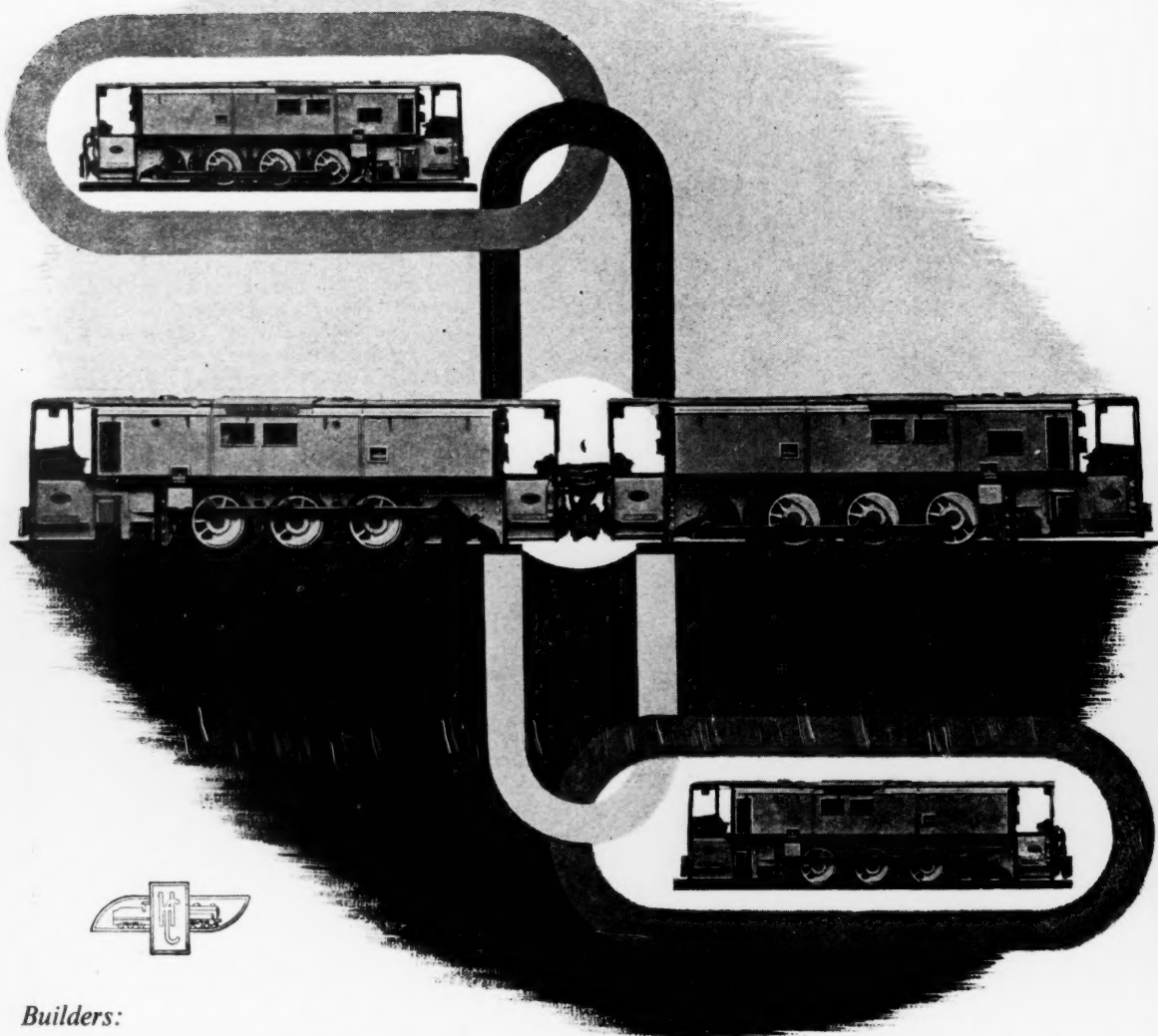
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Brazil

By Our Own Correspondent

CONSIDERABLE expansion occurred in the Brazilian mining industry in 1952, due to growing demands on home and foreign markets. Companhia Vale do Rio Doce mined 1,794,870 tonnes of iron ore and exported 1,507,013 tons, compared with 1,307,473 and 1,273,978 in 1951. Prices averaged \$U.S.15.63 per ton. Contracts are already signed to ship 1,200,000 tons in 1953 at \$U.S.18.00. The Company is now preparing to double export capacity.

Expansion in Manganese Production

Exports of manganese increased from 64,000 tons, in 1951, to 120,000 in 1952, the average price rising from \$U.S.21.65 to \$U.S.31.54 per ton. The Brazilian subsidiary of U.S. Steel Corporation (Meridional) signed contracts with Sociedade Brasileira de Mineracao (Sobramil) for joint exploitation of the Urucum manganese reserves in Mato Grosso, estimated at 33,670,000 tonnes. A \$30,000,000 loan was obtained from Export-Import Bank to import equipment, build a port and acquire ships to convey the ore to a River Plate port for overseas trans-shipment. Meridional aims to export 300,000 tons annually.

In Amapa, Bethlehem Steel, co-operating with Industria e Comercio de Minerios, has borrowed \$U.S.67,500,000 from the Washington bank to equip the Serra do Navio manganese mines and build port and railroad. The American Government will have first call on 70 per cent of the shipments, estimated at 500,000 tons annually. Measured reserves exceed 10,000,000 tons of high-grade ore, with indicated reserves of 20,000,000.

Other manganese beds were worked in 1952 in Minas Geraes and Bahia and a new deposit was opened up at Guacui, Espirito Santo.

Tin—Copper—Gold

The discovery of tin was reported from the Guapore Territory and systematic prospecting of the Amapa cassiterite deposits was undertaken by Brazilian and American engineers. Smelter plant was installed to produce 3,000 tonnes of tin annually at Volta Redonda. Companhia Brasileira de Cobre began re-equipping the Camaqua copper mines (Rio Grande do Sul) to produce 72,000 tonnes of concentrates annually.

Gold finds were reported from Amapa and S. Paulo in 1952.

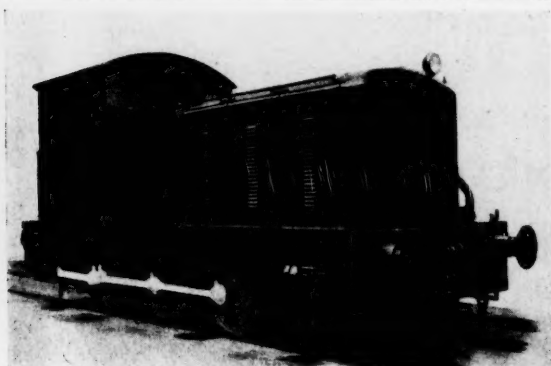
Coal-Oil

Local production of coal remained stationary at 2,000,000 tonnes, but prospecting and drilling for oil were accelerated; 56 new wells were opened and the Bahia fields yielded 108,000,000 litres of crude. The capacity of the Mataripe refinery is being raised to 10,000 bbl. daily and the Government's 45,000 bbl. plant at Cubatao is nearing completion.

Aluminium and Other Minerals

The local subsidiary of Aluminium Union, Canada, began producing aluminium in Minas Geraes and building rolling and extrusion mills at Utinga, S. Paulo. Work was speeded up on the £8,000,000 aluminium factory near Sorocaba, S. Paulo, and plant is being built at Utinga to produce electrolytic copper from the Camaquã concentrates.

Export of rock crystals and beryllium increased in 1952, but shipments of wolfram and mica declined. A Brazilian company was formed to manufacture beryllium oxide, with an initial output of 80 tonnes annually.



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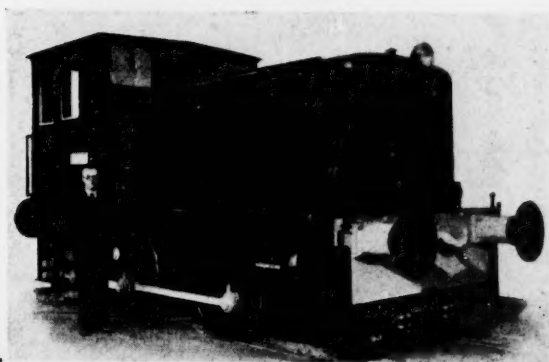
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Bolivia

By Our Own Correspondent

TO report on the situation in Bolivia without discussing politics at their worst is next to impossible.

It also requires a definite viewpoint on the question of whether the situation might not have been different, had the mining companies conducted their public relations programme without identifying themselves exclusively with one group of politicians. It might then be possible to foresee what will be the outcome of the claims for indemnity made by the companies and what kind of policy foreign capital will adopt in its dealings with Bolivia.

The President has six factors to keep in balance. There is the rising nationalism at home and the permanent danger of that kind of revolution for which Bolivia has become notorious. Juan Lechin, Minister of Mines, has promised the workers too much to be able to settle for little even if he wanted to. Conspiracies by disgruntled ex-politicians are helping him towards keeping the President in his camp.

There is, as a second factor, the United Nations commission whose preliminary report was so impressive that assistance is assured from this quarter. This is why Bolivia has been so active in the United Nations. Again, there is Argentina, where a Syrian group with funds accumulated through its activities in Bolivia's textile industry has promised to support the programme of nationalization financially, partly as an anti-Western move. There are—fourth and fifth—Bolivia's relations with the United States and the United Kingdom. Both are anxious not only to maintain Bolivian tin-ore shipments, but to prevent the other fellow from getting too large a share of them.

President Paz Estenssoro, however, still has another factor to keep in mind. It is clear that any Bolivian attempt to win direct access to the Pacific is both hazardous and,

basically, worthless. Her Arica free zone is so much respected by Chile, that the Ibañez Government refused to interfere with Bolivian shipments which the mining companies tried to embargo. The country itself is a desert, a liability rather than an asset. For this reason, Bolivia is looking Eastwards. She cannot break out of the vicious circle of high costs of production—low wages—domestic unrest—loss of productive power and higher costs of production, unless she pays more attention to the development of the Llanos.

The nationalization of the Patiño, Aramayo and Hochschild mines, in October, 1952, represented the last step in a chain of events which began with the establishment of the Commission for Nationalization of the Mines, in May. The business of the nationalized "Big Three" will be handled by the Bolivian Mining Corporation, created in October, 1952, while the small and medium-sized mines will continue to sell to and through the Banco Minero de Bolivia. Exports of tin-in-ore during 1952 totalled 31,950 tons compared with 33,134 tons in 1951.

The Bolivian Government is also working the Corocoro copper mines whose production dropped from 6,600 tons in 1948 to about 4,500 tons in 1952 and which was about to be closed down by its U.S. owners in July last when the government took over.

Lead production as well as that of zinc are on the upgrade—both metals coming mostly from nationalized mines. Lead production is now around 32,000 tons, 20 per cent above 1948/49 level. Zinc production rose from 21,119 tons in 1948 (17,683 in 1949) to 38,000 tons in 1952, the most important producer being the Matilde mine near Lake Titicaca which was nationalized in October, 1952.

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New Zealand

GOLD and metal mining in the Dominion continue to decline, the production of metal, other than gold being of such small proportion that it is restricted to working parties only, who make a small contribution of antimony and tungsten ore. Early in the year it was reported that some attention was being given to the re-opening of old lead workings with the view to determining if tonnages and grade would warrant the erection of a smelter, but there is no information as to progress. For many years gold mining was prominent, but the year saw a rapid decline, to an extent that lode mining practically ceased.

In the South Island, a collapse of ground at the main pumping shaft of Reefion Mines was so serious that the expense of re-opening was considered unwarranted and this old and important mine was closed down. The Martha Gold Mine, in the North Island, which was world-famous, after a new lease of life following the devaluation of sterling, again found operations unprofitable, and the final closing down of the mine occurred during the year.

Decline of Alluvial Mining

These events have left alluvial mining as the sole remaining branch of gold mining. This, too, has declined during the year and there are now only six dredges working. A great set-back to the industry was the capsizing of the Arahura dredge, which is the largest of its kind in the Southern hemisphere. The dredge was floated and reconditioned during the year, after three years' submergence; cost of the work was £A.170,350 and dredging is about to commence. Barrytown Gold Dredging, having sold its dredge for shipment to Queensland, is to be wound up.

Grey River Gold Co. treated 3,713,000 cu. yd. of alluvium in the year and recovered 9,633 oz. of gold. Austral New Zealand Mining Co., another of the dredging group, is also to be liquidated.

A proposal was considered during the year for lowering the levels of the Shotover and Kawarau Rivers so that the virgin banks and beds may be explored for gold. The work necessary will involve the construction of weirs.

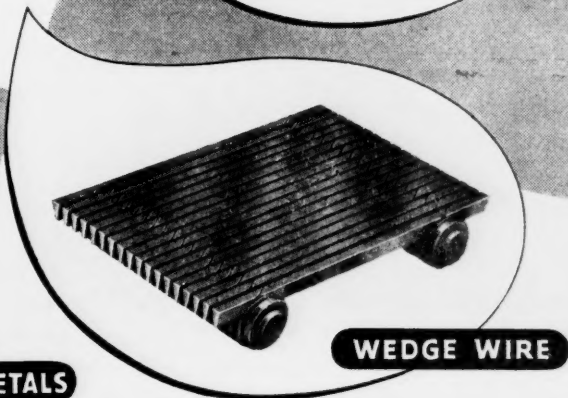
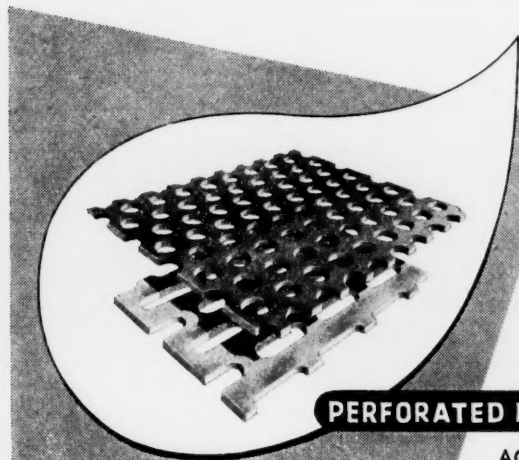
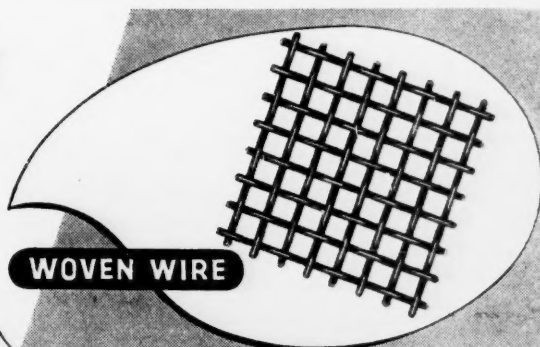
Coal Mining

Mining in New Zealand, with the exception of the few operating dredges, is essentially coal mining, and production of coal will increase in the immediate future. Coal lands have been resumed by the New Zealand Government and mining operations have become largely a State enterprise. Active exploratory work is being carried out, by survey and drilling, for the exploration and delineation of coal deposits, the major objective being the location of large open cut occurrences, suitable for the supply of electricity generating stations, the development of electric power being a leading feature in the Dominion Government policy.

Non-metallics—limestone and clay—were extensively mined, and fairly large occurrences of bentonite, but of low quality, were reported. Other non-metallics were produced in limited quantity.

An interesting feature during the year was the commencement of investigation into the resources and possible utilization of thermal steam in the hot lake district of the North Island as a source of power. The work is as yet in the initial stages, and information is not available.

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Australia

By Our Own Correspondent

THE year, 1952, has been devoid of any sensational occurrence in the mining industry. The big gold and base metal mines have maintained regular production, with in some cases, an increase in output toward the end of the year, an increase that will continue to expand somewhat in the present year. There have been no new mineral discoveries, but the development of mineral deposits is to be encouraged in Western Australia by a grant of £A.250,000 by the State Government. The large mining companies, notably Mount Isa Mines, Zinc Corporation, and Broken Hill South are continuing exploration in Queensland and the Northern Territory, and Western Mining Corporation has continued investigation into gold occurrences in Western Australia. There has been general disappointment that the year has not seen an increase in the price for gold; the decline in the base metal market has had some influence on profits. There has been some belated interest in re-opening old lead-zinc mines, but the fall in prices for these metals, and also for tin and tungsten, may have a greater effect during the current year. The value of shareholders' funds invested in mining is approximately £A.40,000,000 excluding coal.

Gold

There has been a substantial increase in gold production, due mainly to Western Australian activity, the State recording an increase of nearly 100,000 oz. for the period. One new producer, Great Western Consolidated, at Bullfinch, Western Australia, commenced treatment in December, at the rate of 24,000 tons of ore per month, the recovery approximating 2.75 dwt. gold per ton. It is feared that increasing costs, and the static price for gold is compelling companies to work higher grade ore, and to eliminate large tonnages of lower value material from reserves.

Sales of gold on the premium market by the Gold Producers' Association, while helpful, have not realized expectations, and the additional price obtained has done little more than keep returns ahead of costs. From December 7, 1951, to September 30, 1952, profit was £A.900,188, the average selling price being 21s. 5.91d. above the Australian standard price of £A.15 9s. 10d. per oz.

On the cost side, some encouragement was given by the very small rise in the basic wage for the last quarter of the year, suggesting an end to the price spiral. Notable is the success of Central Norseman Gold Corporation which has won £A.1,000,000 worth of gold in 10 months of the financial year, and an average grade of 10 dwt. per ton.

Another event of interest was the proving of high grade gold ore at the 1,000 ft. horizon in the Hill 50 mine, at Mount Magnet.

Silver-Lead-Zinc

Three of the Broken Hill mines have maintained steady production. The fourth, New Broken Hill Consolidated, has completed its ore dressing mill with a capacity of 300,000 tons of ore per year and has commenced treatment. A feature is the use of rod mills. Treatment practice is all-flotation as in the neighbouring Zinc Corporation mill.

Mount Isa Mines, Queensland, appears to have an enhanced future in the development of a new lead-zinc occurrence, 11 miles north of the main mine; results are reported as very encouraging. Ore approximates the grade

and character of the ore in the principal lodes now worked.

Electrolytic Zinc Co., in Tasmania, is increasing production at the Read-Rosebery Mines, and at Lake George Mines, New South Wales, the output rate was continued.

Western Australia has numerous small lead mines and during the year active development was commenced.

There has been an increase in the output of refined zinc at the Risdon, Tasmania, works of Electrolytic Zinc Co., treating Read-Rosebery and Broken Hill concentrate, the surplus from the latter field being exported. Mount Isa and Lake George zinc concentrate were also exported.

Copper

Mount Lyell, Tasmania, had an improved year because of better supplies of coke; ore production is being increased, and the output of metal was higher. Mount Morgan, Queensland, also increased output and has important plans for expansion, as has Mount Lyell.

The new copper concentrating mill and smelter at Mount Isa Mines were completed during the year and treatment was commenced at its close. The copper ore body, as so far opened up, contains 3,000,000 tons of Cu. 4 per

cent ore. Cost of the new plants is stated to approximate £A.3,000,000 and is expected to add 18,000 tons per year to Australia's production, although less will result from the closing down of the most important producer in New South Wales, New Occidental Gold Mines.

Tungsten—Tin—Uranium

King Island Scheelite, Tasmania, the country's big producer, mining approximately 20,000 tons of ore per month, plans to increase output, while Aberfoyle Tin maintained a solid rate of production. Companies formed during the tungsten boom continued operations, mainly in New South Wales, Queensland and the Northern Territory, but most occurrences will prove unsuitable for company operation. They have, however, contributed substantially to output.

There were no new discoveries of tin in the period. The dredge of Tableland Tin, the big producer, is being removed to new leases, and a new company, Raven-shoe Tin, in North Queensland, is preparing to commence work with a bucket dredge bought in New Zealand. There was activity in the Cooktown district and in Western Australia. The main Tasmanian producer continued to be Aberfoyle Tin.

New discoveries of uranium have been reported in the Northern Territory, but none seem important except that at Rum Jungle, the working of which has been taken over by Zinc Corporation Ltd. At Radium Hill, in South Australia, development is proceeding, plant is being erected, and the construction of a uranium treatment plant at Port Pirie, expected to cost £A.1,000,000, has begun.

Pyrite: Sulphur

Production of pyrite for sulphur appears to have become established. Mount Lyell is to increase output, while this branch is to be actively developed by Mount Morgan. In South Australia, preparatory work at the Nairne occurrence advanced rapidly, and production may be commenced this year at the rate of 30,000 tons of ore per month. Western Australia's sulphur ore came from Norseman G.M. where operations were profitable on pyrite alone.

METAL AND MINERAL PRODUCTION

Metal	1950 (000's)	1951 (000's)	1952 (000's)
Gold	889	873	960
Silver	10,677	11,000	*11,500
Lead	225	211	223
Zinc	193	186	203
Copper	17	14	19
Tin	1.8	1.8	1.7
Wolfram	0.3	0.5	1.0
Scheelite	0.8	0.9	0.9
Coal, Black	16,548	17,700	19,500
Brown	7,327	7,700	*8,200
Iron ore	2,365	2,430	*2,800

* Figures for the last quarter of the year are estimated.

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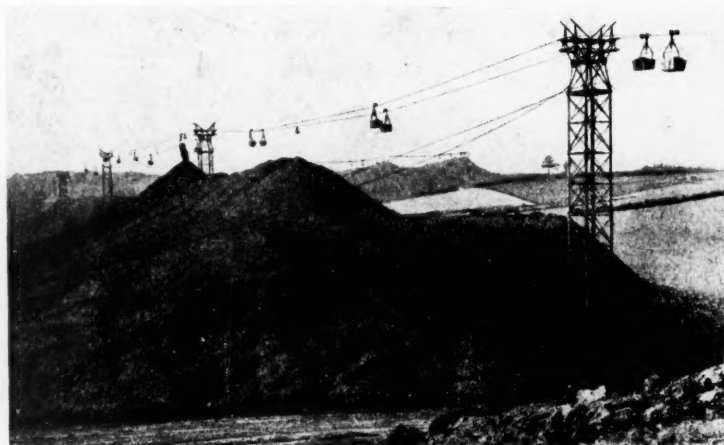
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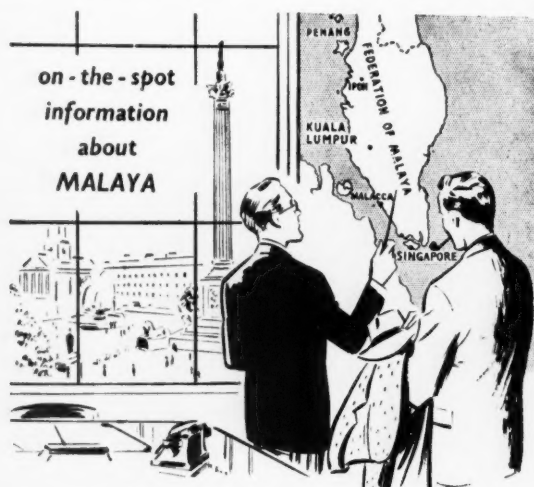
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Malaya

By DICKSON BROWN

TIN is by far the most important of Malaya's mining industries. In 1952 the industry operated under great difficulties in order to produce the maximum quantities of tin ore. These difficulties were caused by the continuation of Emergency conditions under which mines remained under constant threat of Communist guerrilla attacks on personnel and property. However, the year saw a tremendous improvement in this respect and at the end of the year there was every prospect that the improvement would continue. In January, General Sir Rob Lockhart, Deputy Director of Operations, in reviewing progress in the Emergency in 1952 said that the monthly average figure for attacks on estates and mines had dropped to 18 in 1952 from 45 in 1951. The improvement in the Emergency situation is mainly due to the personal drive of the new High Commissioner, General Sir Gerald Templer.

Tin Output Declines Slightly

Production of tin-in-ore for the year was 56,838 tons, compared with 57,167 tons in 1951. In 1950 the total output was 57,537 tons. The Chief Inspector of Mines, Federation of Malaya, Mr. G. F. Gripper, in an official report said that production of gravel-pump mines increased substantially, though the average number working declined, and open-cast mines produced slightly more. All other sources of production showed a decline, particularly dredging in spite of a slight increase in the average number of dredges working. In December, 706 tin mines of all types, European and Chinese-owned, were in operation. The number of dredges working decreased toward the end of the year when several dredges were closed down for major repairs, or dismantling preparatory to removal to other sites. At the end of the year only 80 dredges were in operation, three less than at the end of 1951.

Labour employed by the tin mining industry was adequate throughout the year. There were no strikes or disputes between employer and employed and the workers now enjoy a wage-cum-bonus scheme which appears generally to give satisfaction. The tin mining industry employed a total of 44,678 workers at the end of the year of whom 21,117 were employed by European-owned mines and 23,561 by Chinese-owned mines.

Costs of production continued to rise during the year. At the end of the year there were signs that they had become stabilized and in 1953 it is possible that some decline will take place, more especially in security costs.

The industry, however, has two major complaints, firstly the inability to carry out prospecting operations, for reasons of lack of security, and, secondly, excessive taxation. Representations on both matters continue to be made by mining organizations and in the Federal Legislative Council. It is possible that the security position will permit of a resumption of prospecting in 1953 but it is very unlikely that there will be any reduction in taxation, either by way of export duty or income tax. The Federation Government collected about \$70,000,000 from the export duty on tin in 1952 at rates which have obtained for many years. These rates were determined on an *ad valorem* basis before the introduction of income tax in 1948 and a Government promise then given that export duty would be reduced after income tax was in operation has not been implemented.

The Possibilities of Columbite

An event which may prove of some importance to the industry occurred during the year. By accident it was discovered that in some localities the tin concentrates mined contained small quantities of columbite and this was con-

firmed on analysis by the Geological Department. The quantities are small but they may well grow and some tin mining producers are actively pursuing their investigations. It was also discovered that in heaps of smelter slag at Singapore and in Penang columbite was present and sample shipments from both smelters have been sent to the U.S.

Gold Mining

Malaya has only one large gold mine, The Raub Australian Gold Mining Co., Ltd., which produced about 20,000 troy ounces of raw gold in 1952, compared with 17,000 oz. in 1951. The mine had to overcome considerable difficulties in rehabilitating its mine in Pahang; in obtaining sufficient labour and in facing considerable expenditure on security measures, as the mine is situated in a comparatively isolated area. The company is now conducting investigations into the recovery of scheelite on its property.

Coal

Malaya has only one coal mine, operated by Malayan Collieries at Batu Arang in Selangor. Production for 1952 was 314,922 tons, compared with 382,539 tons in 1951. Production was handicapped during the year by inability to obtain sufficient suitable labour and efforts to recruit workers from outside Malaya were unsuccessful. Considerable new modern mining equipment was installed but even this failed to increase output. This company is associated with a new company to operate a cement works which will require substantial quantities of coal when it starts production in June, 1953.

Iron Ore

Malaya produced more than 1,000,000 tons of iron ore in 1952, all of which was shipped to Japan. The mines are situated in Kelantan and Pahang and were owned by Japanese interests before the war. They were acquired from the Custodian of Enemy Property just after the war by a concern which is predominantly American.

Bauxite

Bauxite production started in June, 1952 and in the second half of the year 21,796 tons of ore were produced. This, like iron ore, is shipped to Japan. These deposits are mainly in South Johore. Considerable investigations have been made into this industry by a Canadian concern and at one time it was hoped that it would be possible to treat the ore *in situ*. This has, so far, proved impossible. Production, however, will tend to increase and a ready market for output is available in Japan.

The Outlook

For 1953 it is not anticipated that the tin mining industry will be able to increase its output. Even if prospecting is resumed it would be impossible to equip new properties for, probably, two to three years. New equipment is still difficult to obtain and long delays have to be faced. Efforts are being made to attract new capital for mining ventures but the present state of the country and the political obscurity of the future is not encouraging such new ventures. For the present, producers prospects are reasonably bright, but it is realized that lower prices for tin will have to be accepted. This may well mean a decline in output, especially from the Chinese-owned gravel pump section of the industry, part of which will have to close down as mining of their low-grade areas becomes uneconomic. This fall in output will be offset to some extent by two or three new or reconditioned dredges which are expected to come into production during 1953.

Indonesia

By KAHONO MARTOHADIMEGORO

INDONESIAN tin production with which this report is solely concerned is obtained from the islands of Banka, Billiton and Singkep.

Mining is at present done by dredging, hydraulicing and gravel pumping. Before the war a lode mine (Klapa Kampit) was successfully operated on the island of Billiton. The Japanese, however, completely destroyed this mine and it has not yet been reinstalled. Operations to this effect may be soon expected. Hydraulicing and gravel-pumping at present account for 30 per cent of the total output and bucket dredging for 68 per cent, while 2 per cent is being produced by small contractors and individual producers. The smelter on the island of Banka was dismantled so that after the Japanese occupation practically all the ore had to be exported.

Post-war rehabilitation of the Indonesian tin industry was rapid and by 1948 production of tin-in-concentrates had reached 30,613 l.tons. Output in 1951 was around 30,000 tons, while in 1952 the figure rose sharply to 35,003 tons, a post-war record which has probably raised Indonesia to the position of second largest tin-producing country in the world.

The tin situation in Indonesia is different from that in many other countries in that the whole of the Banka production is in the hands of the Government, whilst five-eighths of the shares of the other producing company operating in Billiton and Singkep (Gemeenschappelijke Mijnbouw Maatschappij Billiton) are owned by the Government, so that approximately 85 per cent of the profits on tin accrues to the Indonesian exchequer. In this connection it is interesting to note that the contract held by the Gemeenschappelijke Mijnbouw Maatschappij

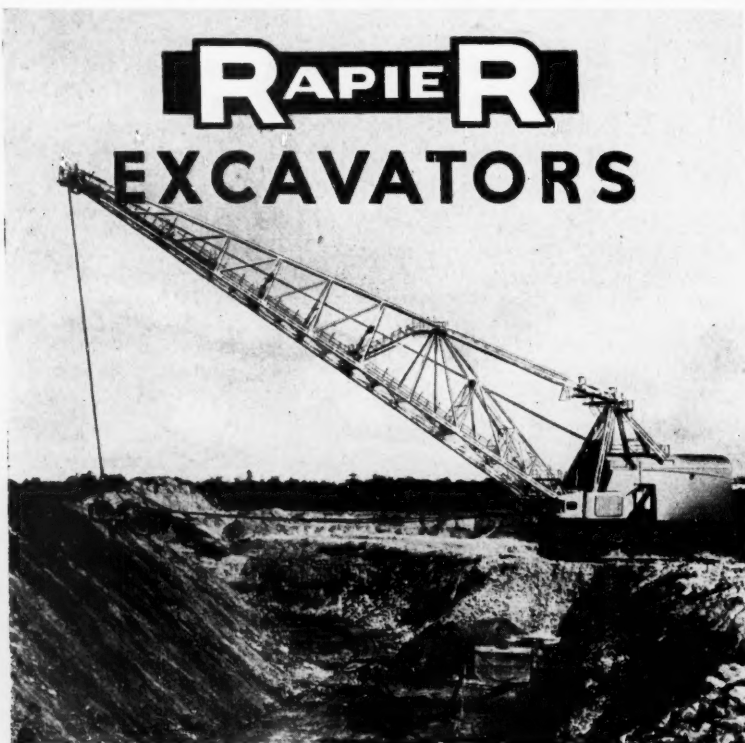
Billiton for the management of the tin mines in Banka, which was due to expire on February 28, 1953, has not been renewed, resulting in the control of the Banka tin mining being taken over by the Government.

In order to ensure the continuity of production under Government management non-Indonesian employees of the Banka tin mining will be retained. Provisionally, the management of the Banka concern has been entrusted to the former Minister of Public Works, Dr. Ukar Bratakusuma, assisted by Dr. Tampubolon, at present director of the State Mining Corporation in Bandung.

Regarding the Gemeenschappelijke Mijnbouw Maatschappij Billiton, in which—as mentioned before—five-eighths of the shares are held by the Government and the remainder are held by the Billiton Mining Co., the present position with certain modifications will be continued until a definite decision is taken.

The tin ore exported from Indonesia in 1952 represented 9.4 per cent of total Indonesian exports. Exports of tin-in-concentrates show a very striking change as compared with 1951. Exports rose sharply from 30,750 tons in 1951 to 34,620 tons in 1952. These went again almost entirely to the Netherlands and the United States. The exports to the Netherlands were, however, for the most part consigned to the Arnhem smelter and subsequently shipped to the United States under the provisions of the American-Indonesian Agreement. Consequently, approximately 65 per cent of the Indonesian production reached the U.S.A.

It should be noted that the high production figures for 1952 are still well below the potential production capacity and plans formulated for a further expansion of tin ore production should ensure a higher output in 1953.



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Japan

By V. WOLPERT

DURING 1952 Japan's mining and manufacturing output increased by 8 per cent over 1951 and is expected to increase by a further 10 per cent in the current year. Last year's increase is considerably smaller than the annual increases achieved during the previous post-war years, and it is noteworthy that advance estimates forecast an increase of at least 10 per cent for 1952. The slowdown of the trend towards increased production was due to large scale strikes in the coal mining and the electric power industries during the last three months of the year, and to a disappointing development of trade with other Asian countries, as well as to the fact that the procurement orders in 1952 did not reach the volume which had been expected.

A break down of the increase in production shows that the mining of metallic minerals increased by 19 per cent and that of non-metallic minerals by 11 per cent as against 1951, while the coal mining remained on the same level. Manufacturing activity increased by 9 per cent. It is evident that the further development of the country's economy will in the last analyses depend on the development of the international political situation.

Coal Mining

When Japan's coal output reached nearly 43,000,000 tons in 1951, representing an increase of over 4,500,000 tons as against the 1950 output, it was hoped that production would be boosted to 49,000,000 tons during the fiscal year ending March 31, 1953. In March, 1952 the output reached the record figure of nearly 4,500,000 tons, which dropped, however, to under 4,000,000 tons monthly during the following months. A comparatively small increase in the second half of the fiscal year would have made it possible to reach the 49,000,000 tons target, but a big set-back was caused by the strike in the fourth quarter of 1952 which lasted 63 days and, according to the Association of the Coal-Mining Industry, led to a loss of output totalling 5,890,000 tons for the 18 big coal-mining companies. The Ministry of International Trade and Industry has drawn up tentative plans which according to *The Bank of Tokyo Review* aims at increasing annual output to 56,000,000 tons within a five-year period, and also to reduce the recently quoted Tokyo price of 7,400 Yen per ton to 5,000 Yen per ton, in order to achieve cheaper production costs in Japan's steel and other heavy industries.

Iron and Steel

The output of iron ore continued to increase and reached a monthly average of approximately 88,000 tons in 1952, as against 74,500 tons in 1951 and 68,500 tons in 1950. It is noteworthy that the output was much higher than in 1937 and 1938, when it amounted to a monthly average of 49,000 and 63,000 tons respectively.

The production of pig iron increased from 256,000 tons monthly average in 1951, to 285,000 tons monthly average in 1952, a record output of 308,000 tons being achieved in May. The production of crude steel also recorded an increase, namely from 533,000 tons in 1951 to 573,000 tons in 1952 monthly average. During the year under review the steel industry concentrated on production of steel plates and pipes which had an export market, and stocks held by the industry and the wholesale trade decreased from 612,000 in April, 1952 to 474,000 tons in December, 1952.

REFINED METAL PRODUCTION

Unit	1951	1952
Primary Copper...tons	43,000	48,700
Secondary Copper tons	46,400	44,300
Tintons	579	574
Primary Lead.....tons	10,600	14,850
Secondary Lead.....tons	6,025	3,650
Slab Zinc.....tons	55,500	70,000
Prim'y. Aluminium tons	36,300	42,100
Gold.....oz.	177,000	175,000
Silver.....oz.	7,000,000	7,500,000

Non-ferrous Metals

Japan's copper industry is still suffering from the effects of the war, during which military requirements of copper were very high and the mines were worked uneconomically in consequence. The *Fuji Bank Bulletin* stated recently that "reckless diggings ventured without regard to prospecting resulted to devastate resources and facilities to an extreme." The post-war period has witnessed a steady but insufficient recovery of copper ore production, and electrolytic copper output has had to rely upon the supply of domestic scrap. The scrap supply is, however, decreasing, and if the mines are unable to increase this output, Japan will have to import copper ore and scrap.

Japan's non-ferrous industry had a boom year during 1951 owing to the rearmament programmes of the Western countries and to large procurement orders placed by the U.S.A. This development led the aluminium companies to establish new plants, and the 1951 output reached a post-war record, surpassing the initial programme by 8 per cent. The bringing into operation of new plants has led to another increase in 1952, but during the year the industry began to experience pricing and marketing difficulties.

A considerable increase of slab zinc production also took place in 1952.

Oil Industry

At the end of 1952 the Japanese Ministry of International Trade and Industry drew up a five-year plan for the oil industry which envisaged that the present annual production of 4,400,000 kilolitres should remain unchanged during the first two years of the plan, namely the fiscal years 1953 and 1954, but then be increased gradually and reach the target of 5,470,000 kilolitres during the 1957 fiscal year, including 1,800,000 kilolitres gasoline, 2,400,000 kilolitres heavy oil, and 1,300,000 kilolitres of other products. The plan estimated that even this increased production will not be sufficient to cover consumption, and that during the 1957 fiscal year 100,000 kilolitres of gasoline and over 1,000,000 kilolitres heavy oil will have to be imported.

Silver and Gold Prices

The control of silver was abolished in June, 1952, when the Government repealed the 15-year-old ban on free marketing and export. Due to heavy stocks, producers reduced what had been the Government's fixed price of 9,700 Yen per kilogram to 9,317 Yen, and requested the authorities for permission to export the surplus. Two months later the price paid by wholesalers to the producing companies was increased to 9,393 Yen. In January, 1953, Japanese silver producers increased their quotations to 9,600 Yen following the increase in the silver price in New York.

According to preliminary figures gold production in 1952 remained on about the same level as in 1951. To encourage greater production the Japanese Government decided to pay producers the full price of 405 Yen per gramme (instead of 401 Yen as in the past) and to allow them to re-purchase from the Mint (to which they have to sell their entire output), a higher proportion of their deliveries for resale to non-monetary users.



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India

By Our Own Correspondent

MINING activity in India continued to be maintained in 1952 with greater vigour than in previous years. There was increased industrial activity in the country and the output of minerals had necessarily to be increased. To further geological prospecting and exploration for minerals, ores and oil, the Indian Government is considering the establishment of an All-India Geophysical Institute.

Coal

Coal was one of the principal mineral products of India last year. The production of coal in India is now completely entrusted to the National Coal Board.

India has a vast field for the export of various grades of coal. Consignments of the mineral went last year to Europe and South-East Asia, including Japan. Last year India exported 2,622,290 tons of coal valued at Rs.92,962,386. The total production of coal was about 35,000,000 tons as compared with 33,800,000 tons in 1951.

Iron Ore

There are at least 20,000,000,000 tons of high grade iron ore in India and exports can, therefore, be accelerated to almost any extent, and were in fact stepped up last year, especially to Japan. Total exports last year amounted to 494,265 tons of iron ore valued at Rs.23,093,316, the principal recipient being Japan with 198,184 tons.

Mica

India is the largest producer of the best quality mica in the world, supplying approximately 80 per cent of the world's requirements.

The principal deposits of mica in India are in Bihar, Rajputana and Madras. Mica fields in Bihar extend over an area of about 1,500 sq. miles. Monghyr bears the richest veins and produces the best quality ruby mica in the world. Mica is exported, the principal buyers and consumers being the U.S.A. and the United Kingdom. Last year the exports were 1,269 tons of mica blocks valued at Rs.21,711,629; 5,167 tons of mica splittings valued at Rs.47,929,022; 913 tons mica scrap valued at Rs.11,844,971 and 697 tons of mica of mixed description valued at Rs.10,787,258.

Manganese

Annually 600,000 to 800,000 tons of manganese, valued at about Rs.75,000,000 are exported from India. Last year she exported 690,000 tons valued at Rs.108,599,456 as against 533,000 tons in 1951 valued at Rs.50,200,000.

India produces manganese ore of high grade quality of which she possesses extensive deposits. The Government of India has fixed a ceiling limit of 300,000 tons for the export of high grade ore containing more than 48 per cent manganese metal and 400,000 tons of lower grade. The U.S.A. was the chief buyer last year, taking 369,407 tons, worth nearly Rs.63,000,000.

Gold

Production was increased last year at an average increase of 1,000 oz. a month. Output in 1952 totalled 243,608 oz. compared with 226,000 oz. in 1951.

Titanium

Ilmenite is being separated from the beach sands of Travancore in South India and about 250,000 tons of the material is being exported to various countries, much of it going into the production of titanium, said to be the metal of the future.

India is singularly blessed with an abundance of titanium ores. The chief ore is ilmenite and India practically holds world monopoly in the supply of this material. Limited quantities of titanium white ore are being manufactured.

India produced no titanium last year, either of the commercial grade or of the high purity variety.

Sillimanite

Sillimanite also is produced from the beach sands in Travancore, and last year India produced 4,426 tons valued at Rs.1,476,874.

Apart from this, some reserves of rock sillimanite occur in Nongstoin State in Assam. Also estimated reserves of about 100,000 tons occur near Pipra, Rewa State and Madhya Bharat.

The principal importers of Indian sillimanite last year were the United Kingdom with 2,880 tons and Belgium with 954 tons.

Kyanite

The kyanite deposits of Lapsabura, Kuku Dangri and Ghadih in Bihar are unique in the world, the alumina content being sometimes as high as 68 per cent.

The Government of India fixed a ceiling limit of 30,000 tons per year for export in respect of kyanite for the year 1952, from which Bihar supplied 99 per cent of the world's demand for kyanite.

The trading in Bihar kyanite alone has earned India nearly Rs.12,000,000 in foreign currency during the last three years. India in 1952 produced 25,441 tons of kyanite valued at Rs.6,994,924. The following were the principal importers of Indian kyanite last year: United Kingdom, 9,328 tons; Belgium, 4,553 tons; U.S.A., 3,698 tons; Japan, 2,241 tons; Germany, 1,931 tons; Sweden, 1,400 tons.

Magnesite

Last year India exported 38,643 tons of magnesite valued at Rs.4,174,329, of which Japan took 18,997 tons and the U.K. 8,606 tons.

Chromite

After the partitioning of India, important deposits of chromite went to Pakistan.

Resources of high grade chromite in India are now limited, but low grade ores occur in fairly large quantities in the States of Mysore, Madras, Bihar, Orissa and Bombay. Last year India exported 6,210 tons of chrome ore of which the U.S.A. took 5,440 tons.

Bauxite and Aluminium

India exported last year 2,463 tons of bauxite valued at Rs.297,348. The principal countries to which bauxite was exported were Japan, which took as much as 1,338 tons valued at Rs.68,823 and the United Kingdom which took 925 tons valued at Rs.214,125.

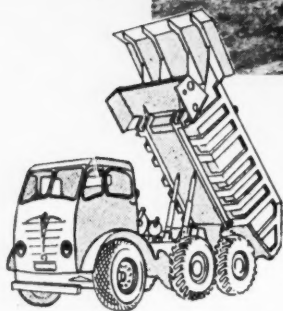
India has a production capacity of 4,000 tons of aluminium a year. Her total requirements of aluminium are 15,000 tons a year. Even so, India exported last year 962 tons of aluminium.

Gypsum

The present sources of gypsum in India are able to meet the requirements of the Sindri Fertilizer Factory, and because of this factory gypsum has become an important mineral for India. There are vast deposits of gypsum in Rajasthan, but the Indian Bureau of Mines has commenced a search for new deposits of gypsum.



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Ceylon

By Our Own Correspondent

LAST year, graphite mining continued to be the most important mining industry in Ceylon, and there was an increase in demand for plumbago as a result of the Korean war.

The total quantity of graphite exported from Ceylon was 7,659 tons, valued at Rs.6,199,606. Though this was less than the previous year's exports, there was an increase in the amount of the better grades of graphite exported, the average price being higher. The following were the principal importers:

	Quantity (Cwt.)	Value (Rupees)
United Kingdom	60,260	1,826,664
U.S.A.	45,340	2,158,688
Japan	20,029	901,570
Australia	8,502	267,365
India	4,350	253,826
Malaya	3,775	212,744
France	2,560	158,160

Mica

The mica mining industry in Ceylon, which had been dormant for some time, showed signs of renewed activity during the latter half of 1952. During the year, altogether 179 cwt. of mica, valued at Rs.3,122 were exported from Ceylon, as compared with 5 cwt. exported in 1951. The chief buyer was India, which took 176 cwt. valued at Rs.2,177.

Ilmenite, Rutile and Zircon

The Government of Ceylon is going ahead with its plan for setting up a plant for the refining of beach mineral sands from the extensive deposits found at Pulmoddai on

the north-east coast of the island. The chief product will be ilmenite with appreciable amounts of rutile and zircon as by-products.

Gem Mining

Precious and semi-precious stones in large variety are found principally in the alluvial gravels of the Ratnapura district in central Ceylon, and in the south-west sector of the island.

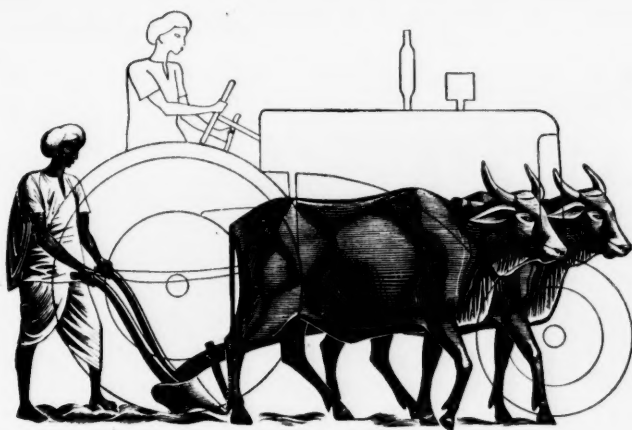
The most important of these are sapphire and ruby; chrysoberyl, including cat's eye and the rare stone alexandrite; beryl and semi-precious stones such as topaz, spinel, garnet, zircon, tourmaline and the gem varieties of quartz. Figures of annual production, however, are not available.

Monazite

Following work carried out by the Department of Mineralogy in connection with the recovery of monazite from certain beach sands found on the south-west coast of the island, the Government has established a pilot plant for the recovery of this valuable mineral. The work is being done with the assistance of a British firm, but the Government will sell the product at the best price available.

Other Minerals

Last year in Ceylon there was a small production of kaolin, quartz and feldspar for the local ceramic industry; and also a small production of glass sand for the local glass industry.



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Yugoslavia

By A. GRAHAM THOMSON

WITH technical and financial assistance from Britain, France and the United States, Yugoslavia is engaged on an ambitious programme of economic development, based on exploitation of her rich mineral resources. Production and exports are being rapidly increased and represent a contribution of growing importance to the West.

Yugoslavia received about \$102,500,000 in aid between April 1948 and October 1952. Of this amount \$12,371,000 was for iron and steel mill materials and products including ferro-alloys. Assistance in connection with non-ferrous metals and products totalled about \$2,230,590 and included \$322,600 for copper, \$1,250,000 for aluminium, \$638,500 for brass and bronze, and about \$20,000 for nickel. Early in 1953, M.S.A. announced that it had authorized Yugoslavia to spend \$2,240,000 in new purchases, consisting mainly of iron and steel mill materials and products. Many millions of dollars have also been made available in loans and investments from the International Bank and Western countries and are being used mainly for the purchase of equipment for mines, factories and collieries, and the construction of power houses. Last year's capital investment programme called for an expenditure of 156,400 million dinars, of which 107,639 million were to be sunk in industrial and mining construction schemes. The programme involved the completion during the year of about a hundred mines, industrial plants and power stations. Plans for 1953 include the investment of 1,200 million dinars for non-ferrous metal industries, the main object being to switch from exports of ores and concentrates to semi-manufactures and finished goods.

Antimony Deposits

Before the war, Yugoslavia was Europe's largest producer of antimony. The Germans denuded the country of her known antimony reserves, so that in 1944 new reserves had to be created before mining could be restarted. All those now known are the result of post-war prospecting and efforts are being made to find additional occurrences. Europe's first plant to treat antimony ores by the flotation process was constructed at Zajaca, where an antimony smelter is also in operation. In addition to a number of small flotation plants in the vicinity, a large unit is under construction. The capacity of the existing plant at Zajaca is 1,500 tonnes of metal annually.

A New Copper Mine

Yugoslavia's only copper producer is the Bor mine in Eastern Serbia. During the war the Germans mined the best ore, so that lower-grade ores are now being worked, necessitating the employment of a larger labour force. Production during the first six months of 1952 averaged about 2,700 tonnes monthly. The increasing difficulty encountered in working the Bor deposits has enhanced the importance of occurrences at Majdanpek in Serbia, where there are reserves believed to be larger than those of the Bor field. A new copper mine will be opened at Majdanpek, and a new smelter with an initial capacity of some 40,000 tons will handle the ore from both mines.

The Aluminium Industry

About 3,000 tonnes of aluminium a year is produced by the Bayer process at Lozovac in Dalmatia, and there is an alumina plant at Moste in Slovenia with an annual output of 8,000 tons. During the first ten months of last year output was at the reduced monthly average of 205 tons, compared with 230 tons in 1951. Bauxite reserves are estimated at over 100 million tons and during Jan.-Oct. last year production exceeded 600,000 tons. As

part of a development programme to increase production the bauxite mines are being mechanized. Self-sufficiency in aluminium will be achieved by the completion of a large new works at Strnisce, Slovenia, which has a planned capacity of some 55,000 tons of alumina and 30,000 tons of aluminium a year. By 1954, Yugoslavia hopes to be producing 22,500 tons of aluminium ingots and 23,000 tons of rolled products.

Lead and Zinc From Trepca

Whereas large tonnages of lead concentrates were shipped before the war, exports now consist exclusively of refined lead. The Trepca lead-zinc properties are the largest of their kind in Europe and reserves are estimated at 10,000,000 tonnes, but the grade of ore becomes progressively lower with depth. The Zvecan mill and smelter are being extensively reconstructed. The present output is about 55,000 tons annually. An ultimate production of 70,000 tons is envisaged, but difficulty is being experienced in increasing the present labour force.

Quicksilver—Wolfram

Yugoslavia is Europe's third largest producer of mercury and output now exceeds 500,000 kg. a year. Further expansion is envisaged in the immediate future and it is anticipated that an output of 600 tonnes a year will be achieved in three or four years' time.

Work on the development of Yugoslavia's first wolfram mine and plant for the separation of wolfram is nearing completion. Production of wolfram concentrate was expected to start towards the end of 1952 and the concentrate will be processed at Sibenik to produce ferro-wolfram.

Chrome—Magnesite

Yugoslavia is one of the world's largest chrome ore producers. The ore is used largely for making ferro-chrome. An output of 2,900 tons of super-refined quality is exported annually and other qualities are produced for home consumption. There is a magnesite mine at Goles, near Pristina, which will be equipped with plant to permit the production of 50,000 tons of caustically roasted magnesite, and two other new magnesite works are also planned. Large deposits of chrome and magnesite have been discovered in south-west Serbia.

Coal, Iron and Steel

When iron and steel plants now under construction are completed, Yugoslavia will produce annually about 2,500,000 tons of iron ore, 540,000 tons of pig iron, 900,000 tons of raw steel, and 600,000 tons of rolled steel products. The coal output is being increased by 2,000,000 tons a year. New power plants with a combined capacity of 100,000 kW. were scheduled to come into operation in 1952 and another six with an output of 60,000 kW. in 1953.

Capital For Further Expansion

Intensive exploration for metal ores is yielding encouraging results and a further stimulus to minerals development will be provided by an extensive programme of railway and harbour construction, together with the building of hydro-electric plants.

Early this year the International Bank announced a loan which will pay for the import of equipment needed for 27 projects. These projects will increase the production capacity of iron ore by 900,000 tons annually, pig iron by 260,000 tons, steel ingots by 275,000 tons, and finished steel ingots by 195,000 tons. New processing plants will make it possible for Yugoslavia to produce an additional 60,000 tons of alumina and 15,000 tons of aluminium.

Spain

By Our Own Correspondent

THE most notable achievement in the Spanish mining campaign of 1952 was in the coal industry. Domestic production was: bituminous 10,213,828 tonnes; anthracite 1,820,812 tonnes; brown coal 1,598,303 tonnes, making a total production of 13,632,943 tonnes as compared with 12,826,148 tonnes in 1951. Imports aggregated 1,099,780 tonnes comprising 643,517 from Great Britain; 189,714 from the U.S.; 117,644 from Germany; 77,082 from France, and 71,821 from Algeria, Belgium and India.

Production of iron ore and pyrites also showed considerable increases. Iron ore (Spain & Africa) totalled 3,851,259 tonnes in 1952 (3,240,724 in 1951), while the figures for pyrites in the same periods were 2,150,684 tonnes (1,806,000). Pyrites exports barely exceeded those of 1951, the chief importing countries being U.K. 422,236 tonnes, Germany 358,059, Belgium 243,227, France 230,934, and Holland 222,211 tonnes.

Among the steel alloy metals manganese and wolfram mines were the most prominent. Production of manganese ore was 29,485 tonnes compared with 23,059 in 1951; while wolfram was 2,736 tonnes against 1,864.

The Earthy Ores

In the earthy ores section new applications and uses of magnesite stimulated output though so far only the small field of Escorial near Madrid has been in operation. But another more extensive area had been opened at Eugui in Navarra. Total output last year was 15,138 tonnes. The production of ilmenite last year was 1,345 tonnes. The output of graphite of 65 per cent content was 443½ tonnes, and of graphitic earth containing 7-11 per cent graphite 4,182 tonnes. Of fluorspar the production was 125,418

tonnes of crude, 47,112 of metallurgical grade and 26,152 tonnes of acid. 27,010 tonnes of crude and 20,405 tonnes of metallurgical grade were exported.

Potash production was rather lower totalling 974,351 tonnes containing 164,171 tonnes of K_2O , against 1,088,884 in 1951. Exports in terms of K_2O were 111,132 tonnes.

Metalliferous Output

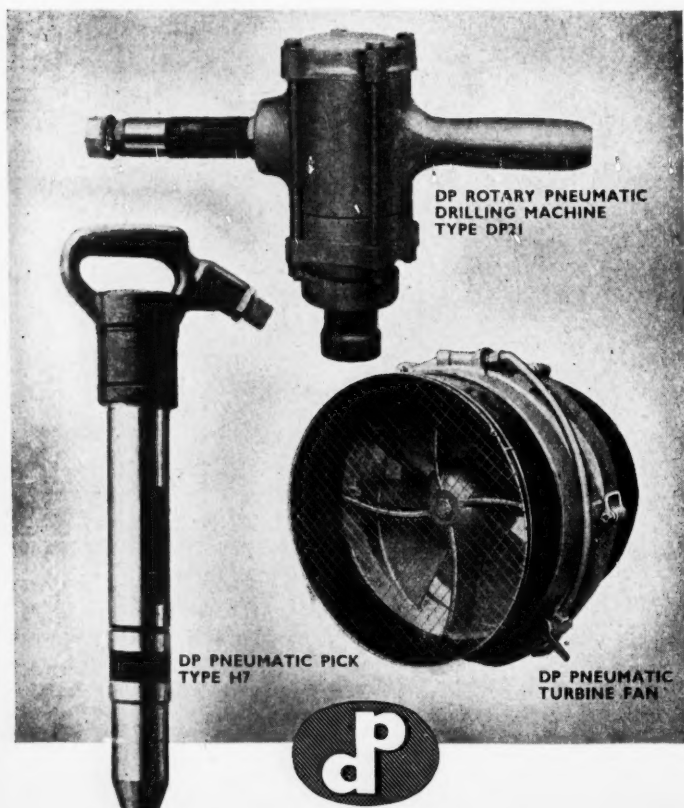
Though there was only a small rise in the output of lead, the constantly rising trend shows the steady effort being made to develop the lead mining industry. The output of metal was 43,152 tonnes against 40,811 in 1951. Three tunnels are in progress which should reveal the lead prospects at deeper levels in the districts of Linares, Cartajena, and Sierra Almarera in Almeria.

Production of silver by cupellation produced 25,365 kilos against 18,872 in 1951.

Production of tin last year was 803 tonnes against 898 in 1951, and of cassiterite 1,279.95 tonnes.

Little information was available regarding quicksilver. Exports in 1952 were 44,000 flasks of 1.275 tonnes. The Almadén administration recently installed two Herreshof rotatory roasting furnaces, each with a daily treatment capacity of 100 tonnes. The scheme for reorganizing underground operations projected three years ago has now been executed at a cost of about £800,000.

The iron and steel industry showed a further advance. The production of ingots was 762,301 tonnes (719,745 in 1951) and of steel 898,025 tonnes (819,190). The persistent advance in output which has already occurred is the more encouraging in view of the rapid progress towards completion of the extensive plants of Aviles in the Asturias.



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Portugal

By Our Own Correspondent

FROM start to finish an unsatisfactory twelve months. Lack of co-operation between the State and holders of mining concessions, the almost total loss of a traditional market, falling prices for tungsten ores and the virtual monopoly of tungsten and cassiterite ores by the dollar area, created a feeling of uncertainty and insecurity. This was reflected in the hesitation shown by exporters to enter into new commitments and a similar attitude on the part of concession owners towards the replacement of worn out machinery or the buying of anything new. An item, possibly the only one, that can be entered to the credit of 1952 was the decision by tungsten consuming countries to limit the calcium content in wolframite ores to "traces only," which put paid to the dumping of a mixture of scheelite and wolframite ore sold as Portuguese wolframite.

The trade had hoped that the fall in the world market price of tungsten ores would be compensated by a corresponding reduction in the export duties. Nothing has, however, been done, and it would be optimistic to expect relief until the amount received by the shipper is less than is the export duty paid.

Diversion to the Dollar Area

The law put into effect in March, which requires 30 per cent of the value (in excess of certain quotas) of exports of tungsten and cassiterite ores to U.K. to be deposited with the Bank of Portugal for an indefinite period, effectively diverted exports to the dollar area. In fact exporters were "advised" to sell to that area. This loss of the U.K. market was viewed with concern, as several U.K. firms had long standing connections with Portuguese firms for both normal grade and low grade mixed residues. The latter, in the shape of WO_3/Sn residues, had a certain outlet in U.K.,

some hundreds of tons being exported each year. Hard hit by the partial blocking of earnings from exports to the U.K. together with the duties of Esc. 16.00 per kilo, a branch of the industry which sold ore that is of no use whatever to Portugal and can be used in U.K., has been knocked out—temporarily at least.

Production and Export Statistics

Principal production figures for the year (in tonnes) were: Tungsten ores 4,244; tin concentrates 1,606; manganese ore 11,065; cupreous pyrites 758,927; white arsenic 1,300; copper concentrates 2,546; copper precipitates 215; gold and silver bearing pyrites 2,173.

Export figures (also in tonnes) were tungsten ores 4,495; tin concentrates 1,654; tin metal 236; cupreous pyrites 412,832; roasted and leached pyrites 323,157; manganese ore 4,138; white arsenic 1,219; iron ore (estimated) 25,000.

That 4,495 tonnes of tungsten ores were shipped in 1952 as against 4,147 tonnes in 1951, means nothing more than that holders of outstanding contracts and those holding stocks of that ore decided to "get out while the going was good or while there was any going at all." That 1,654 tonnes of cassiterite were exported in 1952 as against 1,025 in 1951, means that the increased tonnage was due to the number of smaller mines that opened up during 1951 and 1952. The production of those mines, added to that of the old established concessions, caused an increase in the total production. This production had to be sent somewhere, and for the reasons mentioned above practically 100 per cent went to the dollar area. In 1951 the dollar area took 54 tonnes, in 1952 it took 1,382 tonnes out of a total of 1,654 tonnes.

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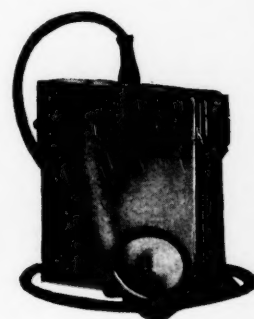
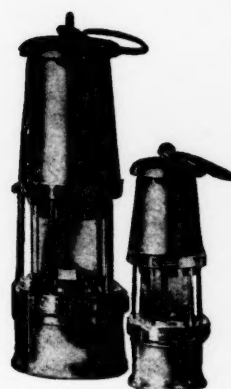
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Norway *By Our Own Correspondent*

THE principal mine products of Norway are cupreous and non-cupreous pyrite, iron ore concentrates, ilmenite concentrates, copper ore concentrates, zinc ore concentrates, lead ore concentrates, molybdenite concentrates, graphite products and native silver concentrates.

The year 1952 was one of progress for Norwegian mining. The most important event was the restarting of production of the Sydvaranger iron ore mines, which were bombed during World War II and have now been rebuilt with government aid. Production started in April on a moderate scale and was increased up to full scale towards the end of the year. 415,000 tonnes of iron ore concentrates (slig) containing 65 per cent Fe were produced in 1952.

Besides Sydvaranger five other mines produced iron ore. They are: Fosdalen Bergverk A/S 248,500 tonnes, A/S Titania 28,000 tonnes, Softestad mines 25,000 tonnes, Rodsand mines 51,500 tonnes and Braastad mine 4,000 tonnes. Total iron ore production was about 772,000 tonnes at a value of about Kr. 60,000,000.

Of these mines the A/S Titania is the only producer of ilmenite; concentrates yielding 118,270 tonnes in 1952.

Production of Pyrite

Pyrite was produced by 12 mining concerns, the biggest of which is Orkla Grube A/B which yielded about 400,000 tonnes of cupreous pyrite, most of which was treated at the metallurgical plant of Thamshavn yielding 100,000 tonnes of sulphur and 14,000 tons of copper matte at 33-35 per cent Cu. grade. The other producers of pyrite were Bjorkaasen 70,000 tonnes, Sulitjelma 60.7 tonnes, Stordo 60,000 tonnes, Killingdal 36,000 tonnes, Follidal 34,150 tonnes, Vigsnes 26,000 tonnes, Fosdalen (by-product) 11,500 tonnes, Skorovas 6,200 tonnes, Mofjellet 5,700 tonnes, Undal 5,000 tonnes, Roros 3,890 tonnes. Skorovas and Undal were new producers. At Fosdalen the pyrite is floated from the tailings of the magnetic iron ore separation. The total pyrite production amounted to 720,000 tonnes valued at nearly Kr. 70,000,000.

Copper ore concentrates were shipped by six of these pyrite mines, the principal of which is Sulitjelma. The others are Follidal, Roros, Vigsnes, Bjorkaasen and Mofjellet. Total production of 1952 was around 23,000 tonnes of a value of about Kr. 20,000,000.

Zinc concentrates were produced by five pyrite mines using selective flotation. Foremost was Mofjellet yielding 5,480 tonnes in 1952, part of which came from the new

Bleikvassli mine. Diamond drillings at the latter have shown big extensions of the ore lenses and increased production is planned. The others are Follidal, Sulitjelma, Vigsnes and Bjorkaasen. The total output was 12,000 tonnes.

Mofjellet also was the only producer of lead ore yielding 690 tonnes of concentrates of a value of about Kr. 1,000,000.

Molybdenite was produced by the Knaben mines, which yielded 195 tonnes of concentrates of a value of about Kr. 1,000,000. The Skaland graphite mine produced 4,100 tonnes of graphite products valued at Kr. 2,333,000. The state mine of Kongsberg produced 9,141 kg. of rich native silver concentrates valued at about Kr. 1,000,000.

The Sydvaranger Enterprise

As already mentioned, a leading event of the year was the restarting of the Sydvaranger enterprise which is by far the biggest iron mining enterprise of Norway. The company was formed in 1906, and the mines reached full scale production by 1915. War in the latter and following years hampered development, but in 1938, 940,000 tons of concentrates were produced. During World War II the mines were heavily bombed, and the plants totally wrecked by the Germans under their retreat from Finnmark in 1944. They have now been rebuilt and modernized at a cost of Kr. 130,000,000, and were started in April, 1952.

The ore deposits lie near to the Russian frontier about five miles from the port of Kirkenes. Drillings have proved the presence of several hundred million tons of ore running 30-35 per cent Fe, of which at least 50,000,000 tons can be worked open pit. The ore is drilled and blasted in benches, loaded by big electric shovels into trucks of 35 and 20 tons capacity which dump it into a 54 in. gyratory crusher feeding a 10,000 tons excavated ore bin. Thereafter it is taken by rail to the crushing plant at Kirkenes. Thence it goes to the mill plant with two sections each of 10 ft. 8 in. x 17 ft. ball mills reducing the ore to 35 mesh. The classifier overflow is treated repeatedly in magnetic separators of the company's own design having permanent magnets, and with secondary grinding, yields a concentrate at 100 mesh running 63.5-66 per cent Fe. The filtered concentrate is treated in rotating tube dryers.

Up to 1942, 26,000,000 tons of crude ore had been extracted yielding 12,000,000 tons of concentrates. Production is now planned at 2,000,000-3,000,000 tons of mine ore yearly equal to 1,000,000 tons of concentrates of 65 per cent Fe at a recovery of 97-98 per cent. The concentrates will probably be pelletized for shipment.



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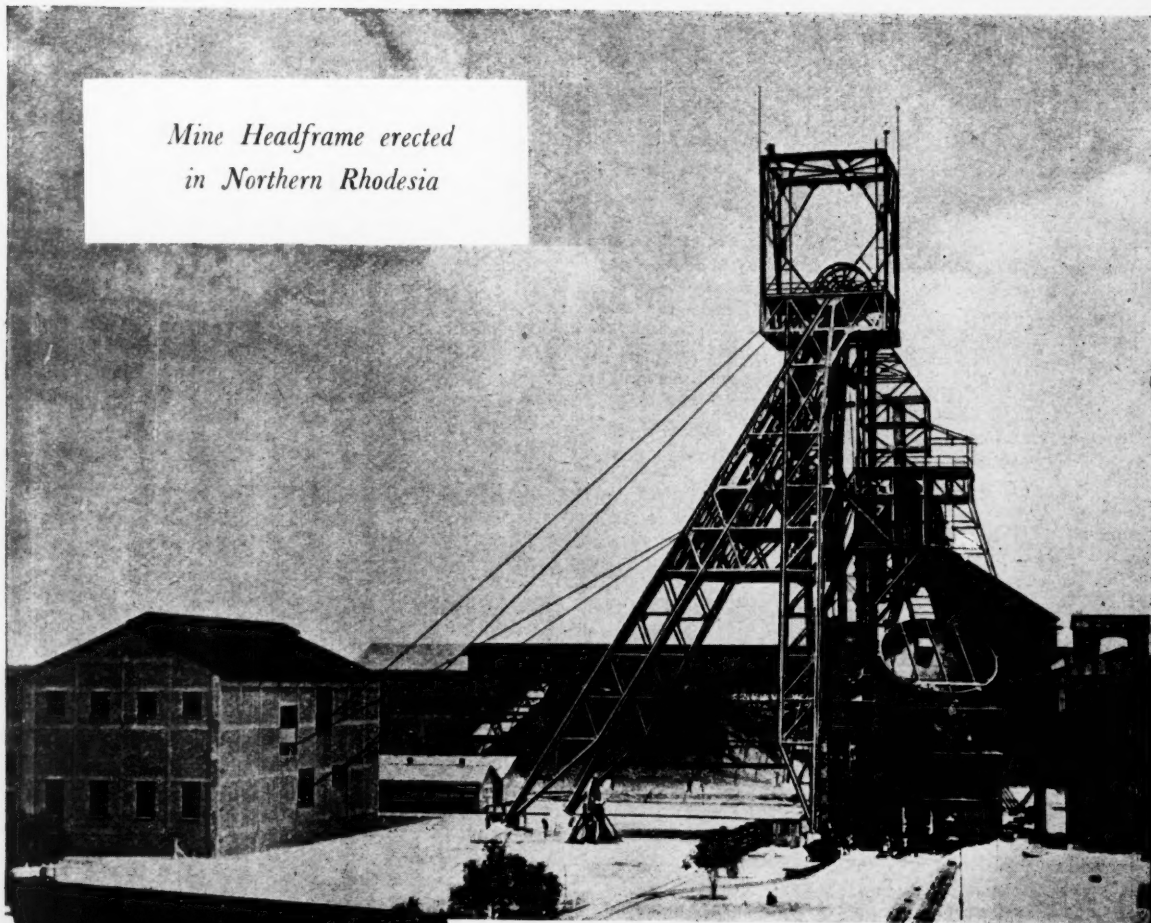
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The Colonial Geological Surveys

DURING the year, 17 additional geologists and chemists were appointed to the Geological Surveys of British Guiana, Cyprus, Kenya, the Federation of Malaya, Nigeria, Northern Rhodesia, Sierra Leone, the Somaliland Protectorate, Tanganyika and Uganda to bring the total overseas scientific staff to 190. The growing experience of the young officers appointed during the last six years is reflected in the increasing production of geological maps and reports. Geological mapping is the most important duty of all Colonial Geological Surveys because it calls for a systematic examination of country and this in turn enables the selection of those areas where mineral developments may be possible. Space is too limited to permit more than a brief mention of a few of the mineral occurrences, some of which were found during recent mapping operations, whereas others have been investigated for a long time and have now become of special interest because they are reaching the production stage.

East Africa

In Kenya, graphite deposits were discovered and examined and more work was done on promising kyanite deposits near Sultan Hamud discovered during the regional survey of that area. Indications were found that the Kakamega goldfield may extend into West Suk. Work continued at the coast in connection with the establishment of a cement industry.

In Uganda, a start has been made to get the Kilembe mine ready for production. The Uganda Development Corporation has been formed to undertake various Government projects and it is co-operating with Rio Tinto, Frobisher, and Monsanto Chemicals in the examination of the Sukulu carbonatite mineral complex which till recently had been the responsibility of the Geological Survey. In the North Valley 2,800,000 tons of apatite have been shown to occur. In other parts of the complex it is hoped to mine pyrochlore for its content of niobium, and magnetite for iron and steel.

In Tanganyika, the pilot plant production of lead at Mpanda has been satisfactory and a full-scale production plant will eventually be installed. A lead deposit recently found in another area is being prospected.

The Rhodesias

A new carbonatite occurrence in Northern Rhodesia is being examined and the investigation of coal deposits in the Mid-Zambesi Valley is continuing. Carbonatite ring-structures in southern Nyasaland have been shown to contain pyrochlore, monazite, apatite and other minerals, and some are being examined by mining companies.

A mining company also is prospecting kyanite deposits in Nyasaland. Reconnaissance mapping of a large area in Bechuanaland indicates the possible occurrence of coking and steam coals similar in quality to those of the Waterberg coalfield in adjoining Transvaal territory, and there is another coal area in Bechuanaland north of Palapye. A limited amount of drilling by the Geological Survey at the old Bushman Copper Mine after geophysical work during the previous season has led a mining company to become interested. A Johannesburg firm is mining asbestos at Moshaneng near Kanye.

The Swaziland Geological Survey has shown by drilling that there are probable and potential reserves of 1,070,000 tons of barytes at Londosi, and that 30,000 tons of ore carrying 0.37 per cent metallic tin are present in a

cassiterite-bearing pegmatite near Mbabane. A mining company is investigating columbite-bearing gravels prospected by the Geological Survey.

West Africa

In Nigeria, a new occurrence of several million tons of easily-mined coal has been found near the colliery at Enugu, and the geological examination of other coal areas has continued. Substantial amounts of deeply-weathered granite carrying columbite about 0.5 lb. per cu. yd. have been found near Jos. In the Gold Coast fairly large deposits of sillimanite-type minerals are being examined. Beds of limestone have been investigated by drilling and shown to be more extensive than had been suggested by surface observations and the erection of a cement factory is being considered.

In Sierra Leone, a mining company is prospecting a gold-quartz lode found by the Geological Survey, and an extensive alluvial ilmenorutile deposit is to be prospected by a company which regards it as a possible source of niobium.

Elsewhere

Geological mapping has been resumed in some States of the Federation of Malaya.

In British Guiana, diamond-bearing gravels, and deposits of manganese ore and of lateritic iron ore have been examined. Much interest has been displayed by mining companies in the mineral deposits of Jamaica following investigations by the Geological Survey.

The mapping of mineralized areas in Fiji has commenced, and the period under review has seen a revival of mining interests in the British Solomon Islands Protectorate.

Other Activities

All Colonial Geological Survey Departments have assisted with engineering schemes, including the Volta Hydro-electric Scheme in the Gold Coast and the proposed building of a large new port at Tema, 16 miles from Accra. Another important task was the geological investigation of the sites for the dam and tunnel in the projected Kafue Gorge Hydro-electric Power Scheme in Northern Rhodesia. Geologists in many territories have been helping with the development of underground water-supplies.

During the year, the Photogeological Section of the Directorate has continued reconnaissance mapping of Sarawak territory and the photogeological mapping of a Karroo area in Northern Rhodesia. Air photographs have enabled a study of ring igneous structures in Nyasaland, and what may prove to be similar occurrences have been detected also on air photographs of Tanganyika. These studies in London enable the attention of field geologists to be directed speedily to areas with the best promise of economic return.

The work of the Mineral Resources Division of the Directorate increased considerably during the year, in investigating samples of rocks and minerals from Colonial territories, in dealing with technical enquiries concerning the mineral industry, and in preparing publications. The quarterly bulletin, *Colonial Geology and Mineral Resources* is now firmly established. Members of the teaching staffs in the departments of geology of several universities have visited Colonial territories during the year to do research on various problems of economic interest.

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The Defence Materials Procurement Agency

THE production of strategic materials for the defence and economic progress of the Free World has been increased substantially since World War II through expansion projects made possible, in part, by U.S. Government assistance under the Marshall Plan.

While the United States Government's materials expansion programme has been concentrated in the main on the further development of domestic resources, U.S. assistance has been extended to a number of projects in other countries. Started over four years ago, the Government's foreign expansion programme involves or has involved projects in the United Kingdom, France, the Netherlands, Germany, Greece, Belgium, Denmark, Turkey, Italy, Portugal, Norway, Austria, Korea, Eritrea, Mexico and Brazil.

To date, the U.S. Government has advanced approximately \$135,000,000 to assist in expanding the production of metals and minerals outside the North American Continent. Of this amount, approximately \$100,000,000 is in counterpart funds of other countries allocated by the former Economic Co-operation Administration and its successor, the Mutual Security Agency. U.S. participation in these projects has been under the direction of the Defence Materials Procurement Agency since the establishment of its Foreign Expansion Division on December 14, 1951. Prior to that it was under the direction of E.C.A.

Aims of D.M.P.A.

D.M.P.A. itself was established by the President on August 28, 1951, to assist private industry in meeting supply goals set by the Defence Production Administration for critical and strategic materials. D.M.P.A. has developed expansion programmes for 17 metals and 22 non-metallic minerals. Of the metals programmes, seven have been completed and all but two are 70 per cent complete or better. In the non-metals, 13 programmes are complete and all but three are 70 per cent complete or better.

The E.C.A.-M.S.A.-D.M.P.A. programme has resulted in increased production of lead and zinc in French Morocco, bauxite in Jamaica, industrial diamonds in French Equatorial Africa, tin in the Belgian Congo, manganese in Brazil. All told, there are 40 expansion projects involving U.S. dollars and counterpart funds.

Under the E.C.A.-M.S.A.-D.M.P.A. programme, money is advanced to private firms or, in some instances, governments to finance in whole or in part the expansion or development of mining properties and related facilities and is paid back in materials as production of the material or materials in question goes forward. In some instances the advances are from funds made available for the purpose from the so-called counterpart or matching funds which countries participating in the Marshall Plan programme have appropriated. (Five per cent of these counterpart funds were turned over to E.C.A. for administrative expenses in the participating countries and for development of mineral resources. Under M.S.A., 10 per cent of the counterpart funds are allocated for these purposes.)

The Programme in Action

One of the outstanding examples of how the programme works is in the production of bauxite in Jamaica. In 1950 and 1951, two big projects were undertaken to increase production of this vital aluminium-making material. Under one project, E.C.A. advanced to the Reynolds Metals Co. (U.S.A.) and its subsidiaries, Reynold Jamaica Mines, Ltd., and the Reynolds Mining Corp., a total of \$9,247,000 from its own funds and the equivalent of about \$6,250,000 in pound sterling counterpart. In addition, the companies

spent approximately \$2,500,000 of their own capital in exploration and development. The project was developed in two stages, boosting production first to 410,000 tons of bauxite a year and then to 750,000 tons.

A similar project was worked out with Jamaica Bauxites, Ltd., a subsidiary of the Canadian firm, Aluminium, Ltd., involving the advance of \$2,500,000 in E.C.A. funds and the equivalent of \$4,200,000 in British counterpart. The company, in this instance, made an initial investment of the equivalent of \$3,400,000 in Canadian dollars. The project calls for annual production of 40,000 tons of alumina (semi-processed bauxite).

Projects involving the mining of bauxite in Greece which is then shipped to Germany for processing have been similarly financed with E.C.A. and counterpart funds. In all instances the funds are repayable in material at the market price prevailing at the time of delivery.

In carrying out its functions, it has been the policy of E.C.A. and D.M.P.A. to work with industry; not to compete with industry. It is also the policy not to compete with private capital but rather to induce additional private investment in mining enterprises. Government loans are certified and advances made only when private capital is lacking or unwilling to assume certain risks.

Many materials essential to the national defence are not produced in sufficient amounts, if at all, in the United States. To meet requirements which the U.S. is not able to satisfy through increased production at home, D.M.P.A. stimulates additional production in other areas of the Free World where potential sources of supply are obtainable under amicable and economical conditions of trade.

Four Principal Regions

In connection with its activities in expanding production and supply of strategic materials in other countries, D.M.P.A. has established four principal regions covering respectively (1) Mexico, Central America, the Caribbean area, and the Guianas; (2) all the rest of South America; (3) Western Europe, the Middle East and Africa, and (4) Asia, Australasia and the South Pacific.

It is the responsibility of the regional officers to develop plans and methods for expansion of production and supply of metals, minerals and other materials within their area of jurisdiction; to recommend negotiation of contracts; to service contracts which have been executed; to make spot purchases; and to arrange for transportation and storage of materials.

In addition to these responsibilities assigned to D.M.P.A. under the U.S. Defence Production Act, the Regional offices have certain responsibilities with respect to stockpiling and foreign aid programmes delegated to D.M.P.A. by the General Services Administration, as well as responsibilities in the field of basic materials development assigned by M.S.A.

Pursuant to authority granted to the Defence Materials Procurement Administrator by the Administrator of General Services, the regional offices purchase strategic and critical materials under the Stockpiling Act of 1946. In addition to actual purchasing, the offices are responsible for such related functions as inspection, custody, beneficiation, processing, rotation and disposal of materials.

In its domestic programme, D.M.P.A. has employed several forms of assistance to aid industry in expanding the production of needed metals and minerals. Chief among these have been accelerated amortization of facilities for tax purposes, agreements to purchase stipulated quantities of materials at stipulated prices and loans or advances of Government funds.

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Metal Mining in Great Britain

By J. B. RICHARDSON, A.R.S.M., M.I.M.M.

IT is difficult to start discussing this subject without exposing a little of the background. On March 1, 1918, Sir Lionel Phillips, Bt., then Controller of the Department of the Mineral Resources within the U.K., presented a detailed report to the Minister of Munitions recommending that the Government should, in the public interest, concern itself more actively than hitherto with the mining and mineral industries. He also called for tax exemption of profits spent on developing properties and recommended that the Metalliferous Mines Regulation Act of 1872 be amended. On August 9, 1919 a board was appointed to investigate and report upon the matter and to make recommendations. Other committees were appointed, sat and recommended during the years between the wars and after World War II, in July, 1949, the Report of the Mineral Development Committee was published.

When Sir Lionel Phillips' survey was made there were 116 non-ferrous metal mines working in this country but 35 of them produced over 90 per cent of the ore. The remaining mines were small and inefficiently operated. Output recorded for 1916 was 5,844 tons of tin ore, 16,145 tons of lead ore, 7,747 tons of zinc ore and 356 tons of wolfram concentrates. A small amount of cement copper from mine liquors was produced but no copper ore was raised. Only a handful of non-ferrous metal mines remained working in 1949 producing in terms of metal, 802 tons of tin, 3,177 tons of lead, no zinc and 20 tons of copper (presumably from mine waters).

The Industry To-day

To-day, the number of active tin, lead-zinc and wolfram mines, including even the small ones, can be counted on the fingers and toes and less than four thousand men are employed in them, some of them foreign miners who are reported to be giving good service in Cornish mines.

The total output of lead concentrates to-day is probably not more than 8,000 tons a year from all sources of which Halkyn produces 2,500, and Greenside 1,800, while Parc Mines is authoritatively stated to be producing at the rate of 3,000 tons a year. A few properties in the Pennines produce smaller quantities and the by-product of non-metallic mines provides the rest. Parc Mines are also stated to be producing zinc concentrates at the rate of 4,500 tons a year and Hagg's mine in Cumberland is reported to be re-opening as a zinc mine by the Anglo-Austral Mining Co. Small quantities of zinc concentrates are being produced at a few lead mines. There is talk of Carrock Fell, a wolfram mine in the north of England, re-opening. (The tin and wolfram position in Cornwall is discussed in the next article.)

There is, of course a much more important non-metallic mineral industry in this country employing some hundred thousand workpeople, twenty-five times as many as the number employed in non-ferrous mining. This branch of this island's mineral industry produces a wide range of products, which fall into three main classes of materials: (a) fluxes and other materials used in the iron and steel industries; (b) minerals used in the pottery and glass industries and (c) minerals for road-making and building.

Most of the work is carried out in quarries and opencast workings. Other than salt, the underground non-metallic mines are small units where little systematic exploration and development is carried out. Certainly some of these mines

are employed only in scavenging the gangue materials, barytes and fluorspar, left behind in old lead mines and it is from some of these that there is produced a small amount of galena as a by-product.

The Cambrookeels mine in Weardale is being developed for fluorspar as is also the Blackdene mine in the same district, and Stanhopeburn is still operating its gravity plus flotation mill. All three properties are to produce acid grade fluorspar which previously had only been produced at Eyam in Derbyshire.

Anhydrite is in the picture as a raw material for increasing the home production of sulphuric acid and the now famous potash deposit of the North Riding of Yorkshire is still in the prospecting stage.

To-day this country only produces a tiny fraction of its requirement of base metal ores. Yet only 19 years ago it produced in terms of metal 15 per cent of its lead requirements at the rate of 40,000 tons of concentrates a year mainly from three mines, Mill Close, Halkyn and Greenside.

What is the Future for British Metal Mining?

Those mining geologists and engineers who have made a special study of British mining are certain that it is practicable to establish an economically, as well as a strategically, sound non-ferrous mining industry, but all the prospects are undoubtedly of a type that requires a comparatively large capital outlay and involves a high risk. Many, especially in the lead-zinc areas of the Carboniferous Limestone, are not in the old mining fields, but in adjacent areas, under unfavourable rocks, shales or toadstones, but lodes traversing these sedimentary formations show control of ore deposition by structures such as folds, faults and domes. Detail structure mapping is required as in this kind of prospect diamond drilling will not unfortunately prove tonnage and grade.

However, a recent paper by J. B. Dennison and W. W. Varvill of the Johannesburg Consolidated Investment Co. describes a diamond drilling campaign with a fresh technique to reduce the greatest financial risk—the failure to find ore. The results obtained by them at Llanrwst in North Wales and in County Sligo in Eire were so encouraging that both places are now producing lead concentrates. Recent rumours are that following their core drilling campaign near Matlock, carried out in conjunction with Derbyshire Stone Co. they have sunk a shaft from which a crosscut has cut a 6 ft. lode with values, in places, of 10 per cent lead. Siamese Tin, now joined by Rio Tinto, plan to dewater, sample and re-open the famous lead-zinc mines of Wanlockhead and Leadhills in the south of Scotland. May success attend both these brave ventures!

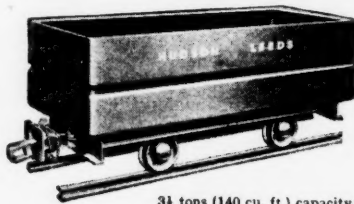
The Government shows little sign of fostering the domestic mining industry in spite of the fact that we are now a debtor nation drawing all but a minute proportion of our non-ferrous raw materials from overseas—not all of them from our friendly sister Dominions and our Empire. Under the present world circumstances it is inexplicable that the Government is not only unwilling to assist in developing our possible resources but in effect has been discouraging mining finance houses from so doing. (One of the causes is the fear of introducing discriminative legislation.) U.S. mining geologists and engineers who have looked into the matter are astonished by our lack of wisdom in neglecting this vital primary industry.

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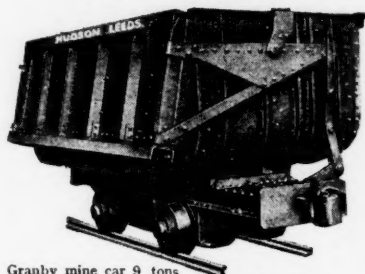
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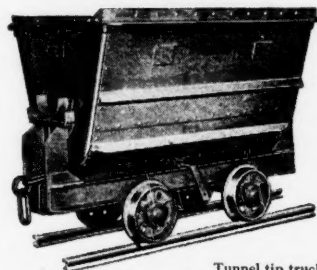
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Cornwall and Devon

By Our Own Correspondent

DURING the year there have been no new developments in the West of England but both South Crofty and Geevor Mines have had successful years, and there has been a steady expansion in the output from South Crofty. Although New Consols Mine continued to work throughout most of the year, the directors decided to abandon operations late in the autumn and the pumps have been withdrawn from the mine. This decision was taken in view of the disappointing development results obtained in driving on the lode and in extensive cross-cutting. It is understood, however, that the company is still interested in the production of wolfram from a detrital deposit on the side of Kit Hill and near their property, from which some output is now being made.

Increased Output at South Crofty

At South Crofty, the output of tin has been increased from 33 tons per month at the beginning of the year to about 46 tons per month for the last month or two. This increase is very gratifying as it indicates that the set-back experienced during 1951, following the serious failure of the Cornish pumping engine at New Cook's Kitchen section of the mine at the end of 1950, has now been overcome. This pump failure was most serious as it caused the temporary abandonment of some of the company's best tin bearing ground at a time when the price was at its highest.

The development footage has also been increased and the labour force expanded by the addition of twenty Italian miners in November whilst it is hoped that a further batch will be recruited in the near future and a suitable hostel has been erected to house them. Four hundred and seventy-four tons of black tin were produced during the year and a dividend of 5 per cent was declared again this year.

At the subsidiary Great Western Ores mines at Castle-an-Dinas it has been decided to deepen the main shaft and explore at a greater depth in view of the results of diamond drilling which indicate that the granite contact is dipping steeply southwards beneath the bottom of the present workings. It was fortunate for South Crofty that this little mine was able to make a good profit on the extremely high price secured for wolfram which materially assisted the parent company's finance.

Geevor Has Good Year

Geevor Tin Mines Ltd. produced somewhat less tin than in the previous year, the output being 653 tons of 65 per cent concentrate for the twelve months ending 31st Dec., but the annual report published in the summer showed another good year with an operating profit of £222,825 and another dividend of 50 per cent was declared for the second year in succession in spite of the continued rise in costs. During the year ending March 31, 1952, some 57,802 tons of ore were mined with an average value of 30.12 lb. of black tin per ton whilst the black tin sold amounted to 740 tons.

Development was good and the important crosscut being driven to cut the Boscawell lodes, made good progress. The new compressor house has been completed and the compressors are being installed so that the new electric hoist can be erected behind the existing hoist and on the site of the old compressor plant. In this way, it will be possible to make the change-over without interference with production.

Elsewhere, the Wolfram Prospecting Syndicate which is associated with the London and Scandinavian Metallurgical Co. as well as New Consols mine, has been re-opening

the Trebartha mine and some production of wolfram has been made.

This mine is situated on the Eastern margin of the Bodmin Moor granite, and the workings which are about 120 ft. below the adit, have been unwatered. Some tin, arsenopyrite, scheelite and fluorite has been reported in addition to the wolfram.

A small production of wolfram is also being made from a small mine near Trebartha.

The management of the Hemerdon mine situated near Plympton and owned by the Ministry of Supply has been taken over by English Clays, Lovering, Pochin & Co., Ltd. Whilst on a care and maintenance basis at present the possibility of reworking the mine is being considered.

As well as the two main tin mines, two other smaller companies are producing some tin, namely, Mineral Recovery Ltd., which is operating a plant at Kieve mill and treating sand from the Gwethian Bay and the British-Malayan Tin Syndicate which is working old dumps at Carnkie near Redruth. Although originally this company worked the dumps of the Basset Mines, they are now largely concerned with sand and other residues from the adjoining Grenville Mine.

Uranium

At Wheal Edward an abandoned mine on the cliff side near Botallack has been sampled by a private operator for uranium and the adit re-opened. This mine was known to carry uranium minerals which are not uncommon in the district and the dumps have been picked on a number of occasions. Old reports speak of uranium and local legend says that some stopes were filled with "black iron" which is taken to be pitchblende. Some 22 years ago an attempt was made to open the mine but was unsuccessful as agreement was not reached with the owners. After working some of the dumps, it was decided to start exploration underground in August and the first shipment of ore from the mine was made in September last.

During the year some diamond drilling has also been undertaken by the Government near St. Stephens on the site of an old uranium mine which produced radium for some years prior to 1927.

The China Clay Industry

The china clay industry in Cornwall has suffered a slight setback in production, figures for exports being lower than for the previous year. In Devonshire, the Devonshire Baryta Co.'s mine at Bridford, which is now operated by B. Laporte Ltd., have reduced output and a number of employees have been discharged owing to the reduction in demand for barytes which forced a number of smaller mines elsewhere to close.

The total labour strength is now under thirty and working is much restricted. If conditions in the barite market improve there is sufficient proven ore, however, for many years. Some Humphreys spirals are being erected to deal with the finer material now treated on tables and attempts are being made to recover the barite from a large slime dump which has accumulated over a number of years.

The small micaceous haematite mine owned by The Ferrubron Manufacturing Co., near Newton Abbot, continues to produce, practically all the output going for the manufacture of Ferrador paint for steel structures. The only other producer of micaceous haematite in the area, however, closed down during the year.

Review of the Share Markets

By Our Stock Exchange Correspondent

THE fiscal period 1952/53 on the Stock Exchange was generally one of little business. Certainly it was the worst year since the war. In the House, firms encountered higher working costs and, in spite of increased commissions, many had to amalgamate.

The year was essentially one of retrenchment. The March budget brought a 4 per cent bank rate which the market had not anticipated. Gilt-edged and fixed interest stocks fell sharply and took some time to find their true level but during the second part of the year a steady improvement occurred. This reflected better overseas balance of payments and E.P.U. figures although, internally, there was a substantial overall budget deficit caused by lower revenue receipts and higher government expenditure.

The strengthening of financial policy had a heartening effect on sterling overseas. While trading conditions remained firm at the beginning of the year, the contraction in markets abroad brought about a sharp recession in certain export trades during the autumn. This was successfully weathered.

Commodity prices mostly continued to fall and the effect on the mining market will be shown in later paragraphs. The change in the Russian Government's attitude from solid intransigence to apparent co-operation following Stalin's death added a spur to the downward tendency, largely because of the better atmosphere prevailing for disarmament discussions and for bringing the Korean war to a close.

Kaffirs

Rand shares began the year with further declines in prices due to increased working costs and the pegged price of gold. A more cheerful tendency set in, however, when it became apparent that other commodity prices were easing. The Commonwealth Conference in December raised hopes of a united onslaught by member governments on the U.S. fixed gold price.

The main feature in this market was the development of uranium, and twenty gold mines were named as producers. Many details of production remain secret, but initial figures received from West Rand Consols indicated a radical change for the better in the profits of the mines concerned. The addition of further companies to the list of producers was confidently anticipated. The salient advantage of South African uranium production is that the mines already exist as gold working propositions and it was unnecessary to find large sums of capital.

Politically, the Union still gave anxiety to many British investors. Apart from differences of opinion between the two major political parties, the surge of native unrest was far from reassuring. Nor has the return of the Nationalist party to power for a further five years allayed these fears. Another persistent trouble was the shortage of native labour caused by the demands of many new developing mines, by uranium and sulphuric acid production plants, and by the Union's expanding secondary industries.

Orange Free State

This field continued to make rapid progress. St. Helena and Welkom both made profits. Other mines are expected to join the list of producers shortly.

Uranium was considered a feature in this field also, and of the twenty scheduled producers, the O.F.S. contributed seven, including five mines in the Anglo American group.

The majority of the money needed for the mines'

development has now been found and 1952 therefore marked the successful surmounting of a major problem by mines in this field.

Diamonds

Diamond shares, although remaining at a high level, showed signs of uneasiness during the latter half of the year. While prices and production remained remarkably steady, investors clearly feared a cessation in the stock-piling of industrial stones and a falling off in the hoarding of gems as fears of war diminished. Profits, though high, were lowered by higher working costs. The Oppenheimer and Williamson interests settled outstanding differences during the year.

West Africans

West African gold shares had a bad time. These companies, registered in the U.K. and operating abroad, felt the full rigour of high taxation and the fixed gold price, although 100 per cent production was sold on the free market. There was clearly little incentive to higher profits. Some mines used this difficult period for reorganization. Ashanti were completing a new shaft and Amalgamated Banket their new grouping. Bremang No. 2 dredge was out of action during the year while being transferred to the Offin River.

At the end of the period, some recovery was apparent. Ashanti Goldfields particularly produced excellent development results.

Politically, events were more stable and gave investors greater confidence.

Western Australians

The Western Australian market lacked interest. This section again suffered from high wages and working costs. The effect of the fixed gold price was mitigated slightly by the sale of 100 per cent output at free market rates. But to the end of the period the labour supply position was easier and the rise in basic wages had been checked.

Miscellaneous Gold

Miscellaneous gold shares were also rather featureless. The same difficulties, high production costs and the fixed gold price, held sway. Exceptionally, Cam & Motor produced excellent development results and the shares steadily improved during the year. An example of the effect of present-day high working costs on some of the older mines was shown by Ooregum, which announced its intention to cease operations.

Coppers

Mines in this group generally returned excellent figures during the year, but investors clearly distrusted the outlook for the metal and, as the year went on, prices fell. Towards the end of the period, there was talk of a resumption of free market dealings and share prices came back heavily.

The Northern Rhodesia copper belt mines suffered from labour troubles as the native unions increased their power. There was one long and serious strike.

The coal position remained unsatisfactory and smelters intermittently had to curtail operations.

The Rhodesia Katanga drilling programme was continued according to plan. The Selection Trust Group received Treasury permission to emigrate after an eight months delay.

Lead/Zinc

During the year, this group suffered a sharp decline despite spasmodic rallying. Both commodities were returned to free trading with consequent heavy falls in price. This inevitably affected profits, and a severe dividend reduction by Rhodesia Broken Hill accentuated nervousness. Consolidated Zinc undertook the development of the Rum Jungle uranium project on behalf of the Commonwealth Government. Mount Isa started producing copper during the year and this had a considerable steadying effect on the share's price.

Tin

In spite of early misgivings, the metal price held remarkably steady on the free market, although, towards the end of the year there were definite signs of easement. No prospecting for new areas was carried out in Malaya, although plans to make a start were formed as the civil war in that country took a definite turn for the better under the able direction of General Templer.

Some Nigerian mines were undoubtedly sustained by the rise to prominence of columbite. The U.S. Government paid as much as £2,500 per ton for this former waste product. Amalgamated Tin doubled its output of columbite over the previous year and other major tin/columbite producers involved, namely Jantar, Bisichi, and Gold & Base Metal, all planned maximum production.

Canadian Dollar Shares

Canadian dollar shares started well but, as sterling recovered in world markets, the premium on share prices fell. A feature during the year was the rise of the Canadian above the U.S. dollar.

International Nickel rose sharply to begin with, but later

followed the general commodity share pattern and fell away. A significant pointer was the increased allocation made to various countries. Nickel output was a record.

Miscellaneous

Tungsten fell in common with many other commodities but Beralts were checked in their decline by the long term contracts negotiated with the U.K. and U.S. Governments.

Manganese shares continued to do well, but in view of the commodity outlook remained below the previous year's levels.

There was a monumental fall in the price and outlook for antimony during the period and the startling fluctuations in the price of Consolidated Murchison reflected the varying fortunes of this mineral.

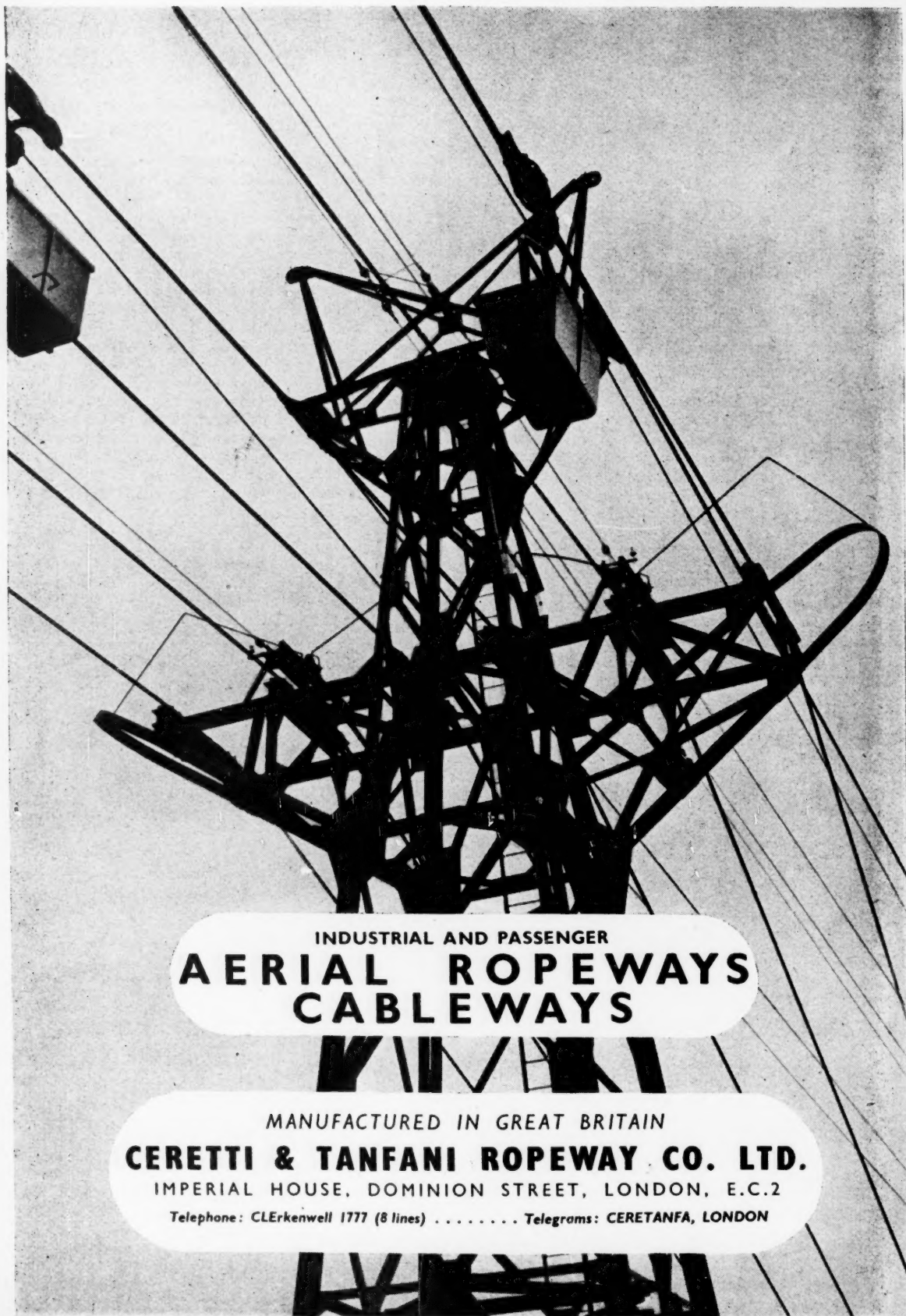
Asbestos shares continued firm during the year. It has many industrial uses, especially in connection with atomic power. Cape Asbestos started production of marinite in the U.K.; and Turner & Newall developed their connection with Cassiar Asbestos in Canada. Asbestos finished the year as one of the few commodities still in strong demand.

Wankie Colliery fell back after a sharp rise in the early part of the year. The market was disappointed by output figures in spite of plans for mechanization, for which suitable labour was difficult to obtain. The copper belt did not receive the full amount of coal required.

1952 was a year of retrenchment; it is hoped that 1953 will be one of consolidation. Nevertheless, the outlook remains clouded by the threat of fierce international competition in trade, and the dim spectre of an American recession. The whole world is now so closely integrated with the U.S. economy that any perceptible reduction in its gross national product would have widespread repercussions.

HIGH AND LOW PRICES REACHED BY LEADING MINING SHARES DURING 1952

	High	Low		High	Low		High	Low		High	Low
Finance			O.F.S. Gold			Diamonds & Platinum			Tin (Nigerian and Miscellaneous) (cont.)		
African & European.....	62/8	38/9	Freddies.....	14/3	6/-	Anglo American Inv.....	5 1/2	77/2	Gold & Base Metal.....	5/1	2/8
Anglo American Corp.....	8 1/2	5	Freddies N.....	15/10	8/1	Casts.....	38/6	23/-	Jantar Nigeria.....	13/9	4/10
Anglo-French.....	22/1 1/2	17/-	Freddies S.....	14/11	6/3	Cons. Diam. of S.W.A.....	91/3	76/3	Jos Tin Area.....	11/4	9/7
Anglo Transvaal Consol.....	27/6	22/6	F.S. Geduld.....	66/10	48/1	De Beers Deft. Bearer.....	79/-	60/-	Kaduna Prospects.....	4/5	3/-
Central Mining (£1 shrs.).....	42/3	31/3	Geoffries.....	22/10	14/5	De Beers Pfd. Bearer.....	16 1/2	13 1/2	Kaduna Syndicate.....	6/4	3/3
Consolidated Goldfields.....	53/1 1/2	39/-	Harmony.....	23/7	17/-	Pots Platinum.....	13/1	7/9	London Tin.....	6/9	4/7
Consol. Mines Selection.....	34/4	22/6	Lorraine.....	10/6	5/4	Waterwaal.....	23/10	13/-	United Tin.....	3/3	1/9
East Rand Consols.....	4/2 1/2	2/-	Lydenburg Estates.....	12/10	7/10						
General Mining.....	5 1/2	3 1/2	Merriespruit.....	6/8	3/-						
H.E. Prop.....	37/6	28/9	Middle Wits.....	21/-	13/3						
Henderson's Transvaal.....	15/7 1/2	7/4 1/2	Ofsits.....	48/1	35/7	Copper			Silver, Lead, Zinc		
Johannes.....	21/3	41/6	President Brand.....	23/1	12/9	Esperanza.....	6/6	3/-	Broken Hill South.....	55/3	38/9
Rand Mines.....	6 1/2	3 1/2	President Steyn.....	21/3	12/9	Indian Copper.....	4/10	3/-	Burma Mines.....	2/4	1/1
Rand Selection.....	46/-	33/9	U.F.S.C. & G.....	22/10	14/-	Messina.....	5 1/2	62/6	Consol. Zinc.....	33/6	21/6
Strathmore Consol.....	35/10 1/2	22/6	U.F.S.C. & G.....	9/7	5/10	Nchanga.....	8 1/2	62/6	Lake George.....	25/-	12/2
Union Corporation.....	38/-	29/3	Virginia Ord.....	14/3	8/10	Rhod. Anglo-American.....	71/9	50/3	Mount Isa.....	47/10	29/-
Vereeniging Estates.....	15	67/6	Welkom.....	37/4	19/1	Rho-Katanga.....	16/9	8/-	New Broken Hill.....	29/1	21/6
Wits.....	37/3	20/-	Western Holdings.....	81/10	58/1	Rhodesia Selection.....	22/10	13/6	North Broken Hill.....	70/9	48/9
West Wits.....	50/-	38/1 1/2				Rhokana.....	26 1/2	18 1/2	Rhodesia Broken Hill.....	21/11	13/6
			West African Gold			Rio Tinto.....	27 1/2	18 1/2	San Francisco Mines.....	37/6	24/6
Rand Gold			Amalgamated Banket.....	2/1	1/-	Roan Antelope.....	15/7	10/7	Uruwira.....	9/-	3/7
Blyvoors.....	45/4 1/2	37/9	Ariston.....	8/6	4/10	Selection Trust.....	49/9	35/3			
Brakpan.....	20/9	14/6	Asanti.....	28/3	15/9	Tanks.....	70/3	52/-	Miscellaneous Base Metals & Coal		
City Deep.....	49/4 1/2	24/7 1/2	Bibiani.....	8/10	5/4	Tharsis Sulphur Br.....	52/6	39/-	Amal. Collieries of S.A.....	55/-	40/3
Consol. Main Reef.....	47/6	28/9	Bremang.....	3/-	1/10 1/2				Associated Manganese.....	58/6	35/-
Crown.....	76/10 1/2	34/4 1/2	G.C. Main Reef.....	4/1	2/9	Tin (Eastern)			Cape Asbestos.....	21/9	14/4
Daggas.....	78/6	58/9	G.C. Selection Trust.....	8/4	5/9	Ayer Hitam.....	29/-	21/-	C.P. Manganese.....	56/4	42/-
Deornfontein.....	29/4 1/2	21/9	Konongo.....	3/8	1/9	Bangrin.....	11/1	7/-	Consol. Murchison.....	5 1/2	24/6
Durban Deep.....	77/6	51/10 1/2	Lyndhurst Deep.....	1/7	9d	Gopeng.....	16/9	9/9	Mashaba.....	1/1	6d
E. Daggas.....	24/8	16/-	Marlu.....	2/-	10d	Hongkong.....	11/-	6/1	Natal Navigation.....	4 1/2	55/7
E. Geduld (4s. units).....	48/6	38/6	Matuqah & Abosso.....	6/3	2/3	Iphoh.....	28/-	18/3	Turner & Newall.....	5 1/2	77/9
E. Rand Props.....	83/6	67/6				Kanunting.....	14/1	9/9	Wankie.....	20/4	14/6
Geduld.....	6 1/2	5 1/2	Australian Gold			Kepong Dredging.....	11/5	5/7	Witbank Colliery.....	60/-	41/3
Govt. Areas.....	16/5	10/-	Boulder Perseverance.....	3/1	1/9	Kinta Tin Mines.....	18/3	11/9			
Grootvlei.....	36/6	25/-	Gold Mines of Kalgourie.....	13/1	8/10	Malayan Dredging.....	26/6	19/9	Canadian Mines		
Libanon.....	17/9	10/4	Great Boulder Prop.....	7/7	4/9	Pahang.....	19/1	12/10	Dome.....	\$34 1/2	\$33
Lupatards Vlei.....	28/-	16/6	Lake View & Star.....	19/9	14/6	Pengkalen.....	13/6	7/9	International Nickel.....	\$89 1/2	\$75 1/2
Marievale.....	23/9	18 1/2	North Kalgourie.....	21/9	17 1/2	Petaling.....	17/9	13/-	Mining Corp. of Canada.....	16 1/2	15
Modderfontein East.....	34/-	18/9	Sons of Gwalia.....	10/9	6/3	Rambutan.....	17/6	11/3	Noranda.....	\$161	\$133
New Kleinfontein.....	35/4	23/9	South Kalgourie.....	8/10	5/6	Siamese Tin.....	26/9	18/7	Quebec.....	18 1/2	16
New Pioneer.....	17/10	11/4	Western Mining.....	12/1	6/9	Southern Kinta.....	17/10	12/9	Yukon.....	5/3	3/3
Randfontein.....	40/9	15/3				S. Malayan.....	30/9	21/-			
Robinson Deep.....	35/7	19/9	Miscellaneous Gold			S. Tronoh.....	23/6	11/9			
Rose Deep.....	35/7	19/9	Cam & Motor (equiv.).....	9/10	7/-	Stungie Kinta.....	24/9	15/6			
Simmer & Jack.....	7/6	4/9	Champion Reef.....	8/10	5/6	Tekka Taiping.....	12/-	6/9			
S.A. Lands.....	48/9	30/-	Falcon Mines.....	10/-	7/-	Tronoh.....	31/9	20/6			
Springs.....	10/6	6/3	Globe & Phoenix.....	26/-	22/6						
Stilfontein.....	27/6	20/1	G.F. Rhodesian.....	7/10	4/9	Tin (Nigerian and Miscellaneous)					
Sub Nigel.....	58/9	38/9	London & Rhodesian.....	6/3	4/-	Amalgamated Tin.....	12/6	8/-			
Van Dyk.....	15/4	8/7	Motapa.....	2/6	1/4	Beralat Tin.....	35/3	19/4			
Venterspoort.....	26/6	14/3	Mysore.....	5/1	2/9	Bisichi.....	5/1	3/1			
Vlakfontein.....	19/3	15/6	Nundydroog.....	6/9	4/-	British Tin Inv.....	20/-	13/4			
Vogelstruisbult.....	34/4	24/-	Oreogum.....	3/7	2/3	Ex-Lands Nigeria.....	7/-	3/6			
West Driefontein.....	6 1/2	5	Oreville.....	13/6	10/3	Geevor Tin.....	16/9	9/9			
W. Rand Consolidated.....	61/-	43/9	St. John d'El Rey.....	40/-	21/6						
Western Reefs.....	48/-	37/6	Zams.....	43/4	32/1						



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Consolidated Gold Fields of South Africa Ltd.

THE original Gold Fields of South Africa was formed in 1887 by Cecil Rhodes and C. D. Rudd, and it was in 1892 on the amalgamation of this company with three other South African mining companies that the Consolidated Gold Fields of South Africa Ltd. was formed. A landmark in the evolution of the group was the formation of an adjunct enterprise—New Consolidated Gold Fields in 1919—for the purpose of overcoming the limitations of its memorandum and enabling it to branch out into new channels of business for which its organization has proved to be eminently suitable. Subsequently, the company turned its attention to the potentialities of the Far Western Rand where the existence of the Witwatersrand system beneath the younger rocks was expected.

In the early thirties, Dr. Reinecke, the company's geologist, and the late Mr. Carleton Jones, consulting engineer, started operations to trace the magnetite bearing shales and, by inference, the Main Reef Group of the Lower Witwatersrand system. Confidence in the possibilities was well-founded and the "West Wits line" came into being. There are to-day five large-scale mines established on this stretch of reef and drilling operations for further expansion continue.

This newer mining venture is in addition to the company's interests in the Central Rand and the Far Eastern section where it has under its aegis gold mines which have helped to make history.

Beyond the Rand the Gold Fields participates in ventures in both hemispheres, associated with mining for gold, uranium, platinum, copper, lead, zinc, coal, oil production, industry, trade and commerce. From this widespread distribution of assets and various other sources the Gold Fields derives its income, through its wholly owned operating subsidiary, New Consolidated Gold Fields.

For the year to June 30, 1952, the company's accounts showed profits of the group to have risen to £3,251,457 against £2,204,081. This figure included £1,759,852 (against £1,219,560) dividends and interest on investments, the balance of £1,491,605 being revenue from other sources. Taxation called for £1,426,162. Excluding the small portion due to outside shareholders, the net balance of the group profits for the year was £1,548,576. Appropriations to reserves amounted in total to £864,542.

The consolidated balance sheet showed fixed assets at £676,913, and investments at £12,921,284, both of which were in advance of those for the previous year while the market value of the latter was stated to be in excess of the figure shown.

The group holds large amounts of American and South African Government securities at £2,716,450; cash stood at £2,593,952. Current assets totalled £8,895,407 and current liabilities £6,976,756.

The substantial increase in profits enabled the company to comfortably maintain a dividend of 15 per cent (a figure to which it was raised the previous year from 12½ per cent), equivalent to 3s. per share.

ORANGE FREE STATE MINING INTERESTS

The company's Free State operating company, New Consolidated, Free State, Exploration Co. Ltd., which has a substantial shareholding in Harmony Gold Mining Co. Ltd., has continued its drilling programme, the best results being obtained in the Saaiplaas area where some highly payable gold values have been disclosed. This area lies just to the north of Harmony.

Subject to favourable results being obtained from further drillings now under way to define the limits of the area, it is reasonably certain that another mine can be established here which would be under the Gold Fields' administration and in which the Free State Co. would have a substantial interest.

Drilling in conjunction with other interests has also been carried out in the Ventersburg—Virginia area.

Outside the practical work in the field, the company has acquired shareholdings in the various mining undertakings engaged in the opening up and development of properties which promise to become gold producers of the future. The company's selection has enabled it to build up a promising portfolio which, in good time, should show capital accretion and be a source of dividend income.

SUB NIGEL LTD.

Exploratory development in the old areas of the mine is being continued. It has been found that in several unmined parts within the main shoot zones, the distribution of gold is of such a nature that the values indicated by development were unpayable and, therefore, did not warrant inclusion in the ore reserves. Experience has, however, shown that some of these areas could be profitably mined, and substantial tonnages have been—and are being—obtained from this source. This, combined with the policy of opening up old areas by exploratory stoping and development, promises to have a beneficial effect on the life of the mine.

In the southern portion of the Eastern Lease Area development work was confined to one heading and the footage sampled proved unpayable. In erosion channel areas, however, although a fair tonnage of payable ore has been disclosed by prospect development it has been decided to suspend operations for the time being because of the limited prospects and erratic nature of gold deposition.

In addition to working its own property, the company has carried out development on behalf of two neighbouring mines—Vlakfontein and Vogelstruisbult and in connection with pumping and ventilation facilities a heading was advanced by Vlakfontein through Sub-Nigel ground to No. 3 shaft Vogelstruisbult.

The company continues to retain a large shareholding in Vlakfontein Gold Mining Co. and the Spaarwater Gold Mining.

ROBINSON DEEP LTD.

A big project was at one time visualized for opening up this already very deep mine to even greater depths but the expenditure involved in relation to anticipated revenue returns put the scheme

MILLING AND DEVELOPMENT RESULTS FOR GROUPS' RAND PRODUCING MINES

Company	Year Ending	Milling Results			Results Per Ton			Development				Ore Reserves			
		Tons Milled (000)	Grade Milled (dwt.)	Oz. Yielded	Revenue s. d.*	Cost s. d.	Profit s. d.	Footage Advanced	Footage Sampled	Per Cent Payable	Value (dwt.)	Width (in.)	Tons (000)	Value (dwt.)	Width (in.)
Sub Nigel	June 1951	796	7.4	296,196	96 5	46 3	50 2	44,526	38,235	34.2	9.7	36.7	1,915	8.4	35.0
	June 1952	794	7.0	277,352	90 0	49 2	40 10	44,717	37,115	32.7	9.3	36.8	1,766	8.4	35.8
Robinson Deep	Dec. 1951	1,350	3.2	213,337	41 4	37 5	3 11	26,821	12,390	48.7	6.1	53.6	2,010	4.1	55.3
	Dec. 1952	1,331	3.4	224,236	43 2	39 10	3 4	26,638	11,795	51.0	7.0	52.8	1,756	4.3	54.7
Simmer & Jack	Dec. 1951	1,508	3.2	239,775	41 7	34 10	6 9	45,650	26,705	38.8	5.4	47.8	2,739	3.8	48.1
	Dec. 1952	1,486	3.2	237,449	41 0	37 4	3 8	47,908	24,065	41.6	6.7	49.8	2,163	3.9	47.7
Vogelstruisbult	Dec. 1951	929	5.0	234,399	66 1	41 10	24 3	50,494	34,235	48.4	6.3	44.4	3,125	5.5	41.8
	Dec. 1952	990	5.2	257,682	66 9	44 7	22 2	51,804	34,495	50.8	6.4	47.2	3,173	5.5	42.3
Luipaards Vlei	June 1951	1,215	3.7	225,466	48 1	33 4	14 9	57,266	32,300	60.0	5.8	45.2	3,002	4.3	47.9
	June 1952	1,189	3.7	221,603	48 1	36 1	12 0	60,105	28,800	62.8	6.5	43.8	2,743	4.4	43.5
Rietfontein	Dec. 1951	326	4.4	72,665	58 2	32 9	25 5	19,690	9,710	38.9	7.7	45.5	531	5.3	50.5
	Dec. 1952	325	4.4	72,087	56 9	35 1	21 8	19,121	9,220	41.5	7.4	44.5	481	5.2	50.8
Vlakfontein	Dec. 1951	444	7.5	165,599	97 3	49 4	47 11	44,885	33,830	29.9	8.8	42.7	1,275	8.8	40.9
	Dec. 1952	447	7.4	165,123	94 7	50 0	44 7	42,028	32,430	29.1	7.9	40.8	1,347	8.6	41.1
Venterspost	June 1951	1,263	4.2	266,301	54 7	34 11	19 8	61,007	24,545	67.1	6.3	57.5	2,790	5.2	57.6
	June 1952	1,180	4.4	260,648	56 11	42 8	14 3	75,650	30,675	53.1	6.3	54.6	2,533	5.4	56.6
Libanon	June 1951	986	3.6	178,299	46 8	33 10	12 10	62,372	23,560	52.2	6.3	55.9	1,910	4.3	55.5
	June 1952	955	3.8	181,968	49 3	38 5	10 10	71,233	32,520	58.7	5.9	59.1	1,737	4.5	56.1
West Driefontein	June 1951	—	—	—	—	—	—	6,448	1,490	100.0	14.0	45.0	—	—	—
	June 1952	115†	8.6	49,193	109 4	66 0	43 4	18,314	10,690	100.0	15.4	45.0	—	—	—

*Includes revenue from premium gold sales.

†From February 1 to June 30.

beyond the bounds of practical economics and the plans were abandoned.

The Technical Advisers thereupon agreed that the interests of all concerned would best be served by limiting the work on the South Reef to known pay zones and to concentrate development on the opening up of the intact tonnage on the Main Reef Leader to an extent commensurate with the existing shaft facilities. Accordingly, it was decided to deepen the Chris and Turf incline shafts and concentrate work on a development scheme which would make this ground available for stoping as rapidly as possible.

Meantime, values are being fairly well maintained, although the pay limit has had to be raised to meet higher working costs.

The mine's proximity to Johannesburg enables it to develop townships on its freehold property and sales thereof bring in occasional revenue.

SIMMER & JACK MINES LTD.

A change in mining policy was brought about on this old Rand producer two years or so ago by the temporary closing down of the lower eastern section owing to ventilation difficulties. The personnel employed there were transferred to the old upper areas of the mine where encouraging results and a substantial tonnage have been obtained. Ore reserves are somewhat depleted, but value and stoping width remain fairly steady.

The western section of the property is also being opened up and work in connection with the layout has progressed. It is from the West Sub-Vertical shaft, sunk to a depth of 2,362 ft. that this part of the property is being worked. To enable full advantage to be taken of this area, the lease of further claims adjoining the western part of the southern boundary has been applied for.

In other directions mining work has gone forward with satisfactory results, while milling has also been reasonably consistent though it has not been possible to utilize the plant to its full capacity of 180,000 tons a month. As with many mines, profits have been on a somewhat lower scale and the distribution to shareholders has had to be scaled down slightly.

VOGELSTRUISBULT GOLD MINING AREAS LTD.

It is just twenty years ago since the Vogelstruisbult was formed to work an extensive area of ground on the Far Eastern Rand. Two shafts were sunk and in view of the great depth of the reef and attendant ventilation difficulties in the western section of the mine, it became necessary to sink a third vertical shaft. This also serves the Sub Nigel with ventilating air as that mine lies to the south-west of Vogels, and an arrangement was reached whereby it participated in the cost.

A great deal hinges on the mine's western section. So far, developments generally have given satisfaction and the Kimberley reef has opened up well. It was as a result of encouraging underground work that it was decided to instal a fourth unit of the reduction plant, bringing the capacity up to 100,000 tons monthly. Although capacity has not quite been reached, there has been a

substantial increase in the mill throughput with a corresponding uptrend in profits.

In addition to the expanded gold production, the company has now joined the list of scheduled uranium producers. Accordingly, a 10-year contract has been entered into with the Atomic Energy Board and a plant is being erected, timed to come into operation by about the middle of 1954. It is estimated that a reasonable profit margin will be provided.

LUIPAARDS VLEI ESTATE & MINING CO. LTD.

Since the end of Luipaards Vlei's financial year—June 30 last—the company has entered into agreement with the Atomic Energy Board to produce uranium.

It has been established that this atomic metal can be extracted in payable quantities from the slimes obtainable from the treatment of ore from the Bird Reef series. Consequently, it has been decided that mining operations, which hitherto were confined to the Main, South, Battery and Montana reefs—as they carry higher gold values—should be extended to the Bird reefs. To accomplish this end the crushing capacity of 110,000 tons per month of the Turk reduction plant is being extended to treat 140,000 tons per month by renovating the sliming section of the old reduction works. The plant for the extraction of uranium is timed to be ready in 1954, and the entire capital expenditure, together with the cost of certain underground development is being obtained on loan, repayable during the 10 year production period.

The Bird reef series have a lower gold content and the annual gold output may show some decline, but the resultant reduction in revenue from the precious metal should be more than offset by the revenue from uranium sales.

Meantime developments on the property continue satisfactory and the decline in ore reserves is due to the exclusion of certain low-grade tonnage resulting from the increase in pay limit necessitated by higher working costs.

RIETFontein CONSOLIDATED MINES LTD.

Although one of the minor companies of the Rand and the Gold Fields group, the Rietfontein has made a very satisfactory showing since it started up just under twenty years ago. Tonnage, outputs and profits, have been small though consistent and dividends have been paid regularly.

The mine is situated to the north of those which adjoin one another along the reef; its nearest neighbour being positioned some two miles to the south. It is underlain by a series of four reefs known respectively as South, Middle, Main and North reefs. Work on them has been of a nature which has enabled the management to make the best showing with the limitations imposed by the restricted area. In recent years, reclamation work has been going on with exploratory development and stoping in the upper levels and in the old eastern section of the mine. Gratifying results have been achieved and the life of the mine prolonged by the conservation of ore reserve tonnage. With the completion of the extension to No. 5 incline shaft, which was undertaken, develop-

FINANCIAL RESULTS FOR GROUP'S RAND PRODUCING MINES

Company	Year Ending	Working Profit Excluding Gold Premium £	Premium Gold Sales £	Revenue from Shareholdings £	Sundry Revenue £	Sundry Expenses £	Taxation and Govt. Share of Profit £	Net Profit after Tax, etc. £	General Reserve £	Dividend		Balance Unappropriated £	Issued Capital	
										Total £	Per Share s. d.		Total £	Share Unit s. d.
Sub Nigel	June 1951	1,850,941	144,502	36,522	32,916	40,091	1,007,536	1,017,254	94,204	974,531	11 0	Nil	885,937	10 0
	June 1952	1,501,949	119,946	29,818	36,606	36,539	825,103	826,677	51,482	775,195	8 9	Nil	885,937	10 0
Robinson Deep	Dec. 1951	129,823	131,932	993	33,472	30,572	34,637	231,011	58,317	200,000	2 0	14,591	750,000	7 6
	Dec. 1952	149,243	70,559	1,512	70,119	14,313	48,997	228,123	84,339	125,000	1 3	33,375	750,000	7 6
Simmer & Jack	Dec. 1951	360,819	146,234	1,277	26,298	34,290	81,441	418,897	241,962	225,000	0 8	21,446	843,750	2 6
	Dec. 1952	194,945	76,316	1,656	33,392	21,251	14,654	270,404	65,537	196,875	0 7	29,438	843,750	2 6
Vogelstruisbult	Dec. 1951	988,464	136,905	1,134	13,117	36,706	475,465	427,449	124,591	502,858	2 0	Nil	2,514,286	10 0
	Dec. 1952	1,020,580	78,386	1,670	13,467	36,314	417,047	660,742	157,884	502,858	2 0	Nil	2,514,286	10 0
Luipaards Vlei	June 1951	783,515	114,696	2,024	18,878	62,669	280,506	575,938	180,782	469,910	2 0	59,445	496,911	2 0
	June 1952	615,163	98,743	1,294	16,356	34,477	160,575	536,504	285,380	310,569	1 3	Nil	496,911	2 0
Rietfontein	Dec. 1951	370,887	44,105	509	2,956	8,392	215,904	194,161	23,226	168,338	3 0	11,444	280,563	5 0
	Dec. 1952	329,188	22,903	1,037	3,450	7,899	176,708	171,771	18,201	147,296	2 7½	17,718	280,563	5 0
Vlakfontein	Dec. 1951	964,285	99,180	657	22,814	22,156	300,662	764,118	275,104	500,000	1 8	8,617	3,000,000	10 0
	Dec. 1952	943,317	52,448	934	25,600	16,935	410,772	594,592	195,449	400,000	1 4	7,760	3,000,000	10 0
Venterspost	June 1951	1,110,685	128,918	1,168	26,028	83,491	456,073	727,235	231,953	510,416	2 1	43,420	2,450,000	10 0
	June 1952	726,909	113,430	1,112	27,536	60,154	224,054	584,779	333,398	285,833	1 2	8,968	2,450,000	10 0
Libanon	June 1951	553,364	79,567	529	17,864	37,366	7	613,951	505,396	99,216	0 3	9,339	3,968,650	10 0
	June 1952	433,012	83,925	791	18,847	34,610	8	501,957	306,689	198,432	0 6	6,175	3,968,650	10 0
West Driefontein	June 1951	—	—	91	46,175	159,610	8,044	—	Nil	Nil	—	—	3,520,540	10 0
	June 1952	*233,575	15,474	84	11,448	9,960	7	250,614	250,614	Nil	—	—	3,520,540	10 0

*From February 1 to June 30.

ment and stoping operations in the north-west section of the mine have been accelerated.

Shortage of native labour has checked progress and to overcome this difficulty, underground mechanization has been introduced although it has added to the already high cost of production. However, the mine continues to make satisfactory progress.

VLAKFONTEIN GOLD MINING CO. LTD.

Vlakfontein is working the extension of the Sub Nigel ore shoots. Work has been concentrated on the southern area, to the west of which a new No. 2 shaft is being sunk. This is in addition to the 6-compartment vertical shaft put down to 5,252 ft., about 4,000 ft. from the Sub Nigel property. Two subvertical shafts sunk therefrom on to the Main Reef cut the latter at depths of just over 6,568 ft. The shaft system is connected with the Sub Nigel workings in order to assist the mine in ventilation. It is this problem which has presented itself and to overcome it a ventilation shaft was sunk in the southern corner of the property, the cost of which was shared by Sub Nigel.

Most of the development work recently has taken place in the south-western area where payability is lower both as regards percentage and average value than the more fully developed section of the mine which follows on from the Sub Nigel shoot system. This affected development results to some extent though, not so the ore reserves which continue to show useful annual additions. In turning to good account the ore resources of the mine, it has been essential to maintain the rate of milling at an optimum figure.

In the matter of shaft sinking and mechanization of productive operations, the expenditure necessary is being financed largely from working profits.

WEST WITWATERSRAND AREAS LTD.

Extensive freehold and mineral rights and options in the Far Western Rand are still held by the West Witwatersrand Areas in addition to its large shareholding in mining companies formed to operate on the "West Wits Line."

The general development of this big area has proceeded rapidly and large tracts of freehold held by the company are becoming more valuable, while the rapid growth of the township of Carletonville indicates that it will become a large and important residential and industrial centre. Apart from the prospects of revenue from afforestation, the value of the freehold is being enhanced by the planting and growth of trees and the general improvement of the "line." Furthermore, there is still a large area which has to be fully explored for precious metals.

The major interests of the company are its holdings in the five mining undertakings established along the "West Wits Line." Of the five mines, four are already gold-producers, namely, Blyvoor, Libanon, Venterspost and West Driefontein, while Doornfontein, the fifth and last to be formed, is making rapid progress towards its initial milling rate of 24,000 tons per month. Blyvoor and West Driefontein have become South Africa's two richest gold producers.

Although much has been done, a great deal remains to be achieved before the development of this comparatively young goldfield is complete. When, however, this expansion is effected West Wits will be in a position to participate substantially.

To the west of Doornfontein there appears to be an area underlain by the Main reef and the Carbon Leader, while to the east of West Driefontein and to the south-west of Libanon, there is a further considerable area which could well be economically exploited.

Drilling has taken place on farms Driefontein 105 and Doornkloof 155, also in the area to the west of Doornfontein where interesting intersections of the Livingstone-Johnstone reefs have been obtained. Intersections of the Main Reef and Carbon Leader have been obtained in drilling both by the company itself and conjointly with other undertakings having interests in the area but no conclusive results have been obtained. The available borehole information has indicated that payable gold-bearing reefs exist, but a designed programme of drilling must be completed and further information gained in order to assess more accurately the potentialities of the area.

Investments held by West Witwatersrand Areas have a book value of £6,777,292 but their current worth is greatly in excess of this figure. The difference is of little consequence as the company's policy is to hold the shares in the operating companies as permanent investments.

In respect of the current year to June 30, 1953, the company has paid an interim dividend of 30 per cent. Previously it has made yearly distributions, since commencing payments during 1947. The last dividend of 50 per cent (1s. 3d. per share) was at the same rate as for the two preceding years.

VENTERSPOST GOLD MINING CO. LTD.

This Far Western Rand member of the group was the first to start production and to give practical evidence of the gold wealth of the "West Wits Line."

Since milling commenced in 1939 the plant has been increased to deal with 110,000 tons a month and a further unit of 25,000 tons is in course of construction but there is need for much greater development before this tonnage is justified. As a result of the company's capital commitments and decrease in working profit there has been a decrease in the rate of dividends paid.

Mine developments continue to give satisfaction both on the Main and on the Contact reefs. Payability on the latter has been high and it promises, in due course, to provide substantial additions to the ore already available. The continuous increase in costs has made it more and more difficult to maintain the ore reserve position in that the unit cost of the work necessary to develop ore is rising and additional material to be classed as payable ore must contain more gold than formerly.

The programme of shaft sinking initiated has gone well ahead and its completion will enable an expansion of underground work to be undertaken. A gratifying feature which must be mentioned is the decrease in the volume of water encountered underground.

LIBANON GOLD MINING CO. LTD.

The mining area of Libanon covers a reef strike of some five miles adjoining Venterspost to the south-west. Of the five reefs being attacked, only the Main and Contact reefs are yielding payable ore and while the pay ratio of the Contact reef is not so good as that of the Main reef, development results continue to be satisfactory and promise to provide substantial additions to the ore reserves.

The company has suffered considerably from the post-war inflation of prices. It is just over four years since milling started and although the plant has a capacity of 100,000 tons a month, full capacity has not yet been reached. Cuts imposed by the Electricity Supply Commission together with the labour shortage and the continued rise in costs have affected operations adversely, thereby adding to the difficulties of achieving improved financial results. The relief obtained from devaluation has been practically eliminated by the inflation costs which has meant a wastage of ore reserves since material previously classed as payable has been rendered uneconomic. Ore reserves have consequently tapered and are now well below two years supply to the mill. The speeding up of development work is, therefore, essential and the capital expenditure programme designed to meet this urgent need is concerned with the layouts on Nos. 10, 11 and 12 levels and with the sinking of No. 1 sub-vertical shaft. The deepening of No. 2 shaft is also going forward. In the circumstances the desired increase in dividends has not been possible but it is hoped to maintain the distribution at its present rate.

DOORNFONTEIN GOLD MINING CO. LTD.

This member of the group was the last of the five mines floated to work properties on the "West Wits Line."

It adjoins the western boundary of Blyvoor and is bisected by a major fault but borehole results indicated that the high Carbon Leader values of its rich neighbour extend some distance into the eastern part of Doornfontein. This is being proved by development, which is taking place from the Annan shaft, the sinking of which was completed at a depth of 4,736 ft. Underground work has opened up ore of good value and payability; it has averaged over 400 in.-dwt. and the payability has increased to over 90 per cent. The Carbon Leader is reported to be a well-mineralized closely-packed conglomerate.

The No. 1 shaft on the property at the end of March last was down to a depth of 4,231 ft. and it is intended to sink it to a depth of 6,500 ft.

Crushing is anticipated to commence by the middle of 1953.

It has been decided to provide an initial plant capacity of 48,000 tons per month, which, allowing for power cuts during peak periods, should at least ensure an initial milling of 24,000 tons per month. As the power position improves the milling capacity will be available to mill at 48,000 tons per month immediately the mine is able to supply the tonnage.

The company is well fortified with liquid resources; it made an issue of 2,808,000 shares at the end of 1951, and the balance sheet at June 30, 1952, recorded its cash resources at £2,778,541.

WEST DRIEFONTEIN GOLD MINING CO. LTD.

Outstanding progress has been made by West "Dries" since milling started on a limited scale in February of last year. Few mines have made such an impressive beginning and outputs have indicated that the confidence shown in this Western Rand property is being fully justified. The tonnage handled is small by Rand standards; the present plant has a capacity of 50,000 tons monthly which, in due course, will be raised to 125,000 tons. Shortage of electrical power is one of the main reasons for current production being below capacity.

The mine is situated immediately east of Blyvoor; it is larger in claim area and the present programme provides for the sinking of four shafts. Underground work has given excellent results with

a continuity of 100 per cent payability. Most of the development has been done on the Carbon Leader but the Main and Ventersdorp Contact reefs promise to yield ore and the mine is listed to produce uranium. Development has been restricted to a few levels, principally the 12 and the two levels above, but with the completion of the No. 2 shaft, preparations for work on six new levels, 13 to 18, are in hand.

With the extension of development the throughput will be increased but a policy has been followed of providing mill capacity ahead of requirements; it has helped to overcome the hindrance caused by power cuts.

Large capital expenditure has been necessary and temporary loan facilities have been resorted to. As a consequence, notwithstanding good profits, it has not been found possible to declare a maiden dividend but ultimate distributions promise to be substantial.

WATERVAL (RUSTENBURG) PLATINUM MINING CO. LTD.

Of the company's other interests in the Union of South Africa, it has a substantial investment in the Rustenburg Platinum group, chiefly through the medium of the Waterval Co.

After many years of development and skilful handling of the problems of mining, refining and marketing, the industry has become of much prominence. The Rustenburg Co. which is the working undertaking, decided to increase the milling capacity of the group to about 120,000 tons of ore per month. It is anticipated that this stage of expansion will be completed this year.

At present the platinum bearing nickel-copper matte which is the mill product, is refined at the plant of Johnson Matthey & Co., the well-known English precious metal refiners at their plant in this country. In order to cope with increased supplies, however, which will be forthcoming under the Rustenburg expansion, Johnson Matthey and Rustenburg have set up jointly another refining plant in South Africa, which will not only account for current production of matte but will also be able gradually to refine considerable amounts which have been stockpiled over recent years.

In the past the demand for platinum group metals has been restricted on account of supplies, but a steady and growing demand for the metals is now confidently anticipated.

MOTAPA GOLD MINING CO. LTD.

When the Motapa Gold was brought out early in 1947 it seemed that a venture of much promise was being launched. It is an off-shoot of the Gold Fields Rhodesian Development Co. and the property is situated in the Bubi district of Southern Rhodesia.

The mine is divided into two sections—the B & S Claims and the Fossicker; two shafts have been sunk and the plant with a capacity of 25,000 tons a month started up in 1948. While milling has been well within reach of full capacity, results have been disappointing. Costs have increased and the yield has tapered, while the refractory nature of the ore has created persistent difficulties.

The ore body, which was at one time of the exceptional average width of 17 ft., has narrowed to around 12 ft. and less. The company has turned its attention to a block of claims adjacent to its own property known as the Pluvius Gold Mines. It has entered into an agreement to develop them for a period up to June 1954 with an option to purchase. This, with the acquisition of other adjoining claims is opening up the way to ore channels traversing the properties for approximately 9,000 ft. of strike.

The future of the undertaking depends to a great extent, on results obtained from this new exploratory work.

LAKE VIEW & STAR LTD.

This forty-three year old West Australian gold producer retains its place as the leading undertaking on the famous Golden Mile.

In spite of many difficulties, the company has continued to operate successfully and the technical position of the mine is very satisfactory; developments are up to expectations and the plant has been operating successfully. The labour position has improved and the replacement underground of new types of equipment has accelerated the opening up of ore. Although a small decrease in reserves was last reported, their aggregation at June 30, 1952, was 3,723,700 tons of 4.82 dwt.—sufficient to last many years at present rate of crushing.

During the year to June 30, 1952, the tonnage milled was 652,247, the grade being 4.76 dwt.—an increase over the previous twelvemonth while a larger tonnage of tailings was retreated. Revenue from bullion was much higher at £1,922,776 compared with £1,751,888 but the benefit was more than absorbed by mine working expenditure, including development and the cost of tailings retreatment, £1,418,750 against £1,167,322. Costs per ton, excluding tailings retreatment, rose by 5s. 9d. to a peak figure of 40s. 11d. The somewhat lower taxation helped to off-load the burden, and the company was able, for the third year in succession,

to distribute 62½ per cent (2s. 6d. per share) to shareholders.

A larger footage of development was accomplished on the mine—23,232 ft., and good results were obtained from the use of light drilling equipment and tungsten carbide tipped steel, which have replaced heavier machines.

Lake View, with other Australian mines, has been getting the benefit of premium sales since November 1951, and now virtually all the Australian gold is going to the free market. The enhanced price obtainable over the standard value has been a helpful factor in combating the advanced costs that the gold industry has had to face.

LAKE GEORGE MINING CORPORATION LTD.

The big lode of mixed-metal ore being worked by the Lake George Mines Pty. Ltd. (the subsidiary of the corporation), plays an important role in Australia's economy.

The property is one of those which was worked in the early days but the lack of knowledge in dealing with complex ore, forced the pioneering interests to abandon it. Many years later, on the advice of the Gold Fields geologist, Dr. MacLaren, renewed attention was given to the mine. It was thought it could be operated profitably, and this has proved to be the case. A high degree of mechanization has been followed and large quantities of metal produced.

The treatment plant which makes use of differential flotation is handling about 570 t-tons of ore a day and yields five products, namely concentrates of lead, zinc, copper, gold and iron pyrites.

During the year to June 30, 1952, the group profit after taxation increased from £291,500 to £390,000, despite many additional burdens especially in connection with increased wages. The main reason for the better figures was the higher prices obtainable for the metals, especially lead and zinc, while there was also a moderate expansion in production. Total realizations showed an advance of over £700,000 to £2,820,000 and the net profit comfortably covered the 90 per cent dividend, raised from 70 per cent in the previous year.

Technically the property gave evidence of being thoroughly sound as, despite a record tonnage of 180,216 tons milled, ore reserves expanded to a new peak of 1,914,200 tons—a rise of 134,000 tons and equivalent to about 10 years mill supply.

Lake George is selling about 25,000 tons of pyrites per annum to the fertilizer industry in Australia, and this, it is believed, can be increased to 50,000 tons. But unless there is a drastic recovery in the price of lead and zinc, revenue and profits are likely to decline.

The company is making every effort to reduce costs by improving the efficiency of the operation, and hopes to benefit from a further reduction in the very heavy rates which the railway is now charging. With so many possible variations, the immediate future is hard to predict. There is every prospect that the mine will be able to produce at least the tonnage represented by the estimated ore reserves and before long, the current prospecting programme may be expected to show whether other ore bodies, beyond those at present known, exist on the property.

CAMP BIRD LTD.

A high level of prosperity has been achieved by Camp Bird. It is now over fifty years since it was formed principally for the purpose of working the Camp Bird Mine in Colorado. Large-scale working of that property has long since ceased but the company still receives some small revenue from it by way of royalty as it is let on tribute.

The main functions of the company now is as a mining-finance enterprise, deriving income from a valuable portfolio of investments which it has built up. It has become interested in gold, platinum, base metals, timber, etc., through shareholdings in companies working in Africa, Australia, Rhodesia, Mexico, etc. Its interests in Africa have spread from the Rand to the Orange Free State and to the undertakings working on the "West Wits Line". These latter include Blyvoor, Doornfontein and West Driefontein. In the O.F.S. an interest is held in Harmony Gold and New Consolidated Free State Exploration, while in the Commonwealth, shares are held in Lake View & Star and Lake George.

The company's interest in Mexico is through its shareholding which it has had for many years in the Fresnillo Co. Inc. working a lead-zinc-copper mine which, although over 400 years old, still has large ore reserves. Another Mexican venture in which an interest is held is Durang Timber.

For the year ended December 31, 1952, Camp Bird's income from all sources amounted to £227,216, and after providing for administration and sundry expenses, there remained a profit of £211,607. Taxation called for £112,316, investment reserve £50,000 and the dividend of 10 per cent (1s. per share), absorbed £57,065. Quoted investments stand in the balance-sheet at £1,098,445 and in addition there are unquoted holdings of £127,360. The market value of the quoted securities, while not exactly obtainable, is in excess of the amount shown.

Anglo American Corporation of South Africa

THE scope and influence of the Anglo American Corporation has continued to expand as opportunities for broadening its investment horizons have presented themselves. Although the cornerstone of its prosperity has been gold and diamonds it has, over the past 35 years or more, brought within its ambit preponderating interests in the Transvaal and Southern Rhodesian collieries, Rhodesian copper and other base metals and real estate, as well as companies engaged in the manufacture of commercial products. To-day the Shareholdings, Notes and Debentures held by the Corporation have a market valuation totalling some £35,000,000. Moreover, it has taken the leading part in the opening up and the development of the new gold mines in the Orange Free State and the initiative and enterprise, which it has shown in this field, forms an essential chapter in the history of the South African mining industry.

The Corporation's profits last year, after providing for taxation, amounted to £3,015,000 compared with £2,894,000 for 1951. The general reserve was increased to £17,900,000 by the allocation of £4,400,000. Dividend distributions for the year again totalled 60 per cent or 6s. per share.

DIAMOND, COPPER AND COAL INTERESTS

From the outset, the corporation has been closely identified with the diamond mining industry and through its large shareholdings in Anglo American Investment Trust which it formed many years ago to administer its diamond interests, it is concerned with numerous diamond companies associated with both the production of gems and industrial diamonds.

Direct and indirect holdings comprise De Beers, Consolidated Diamond Mines of South-West Africa, Consolidated African Selection Trust, Premier (Transvaal) Diamonds, Companhia de Diamantes de Angola, Boart Products, Diamond Purchasing and Trading Co., De Beers Industrial Corporation and the Diamond Corporation.

The whole share capital of the Diamond Corporation is held by De Beers, Consolidated Diamond Mines of South-West Africa and the Anglo American Investment Trust Ltd. In order to concentrate shareholdings in non-Union diamond producing companies as permanent investments in the hands of the Diamond Corporation, certain shareholdings were transferred to the Diamond Corporation last year by the Anglo American Investment Trust in exchange for 2,500,000 £1 shares in the Diamond Corporation. Since then, a new company, De Beers Investment Trust, has been formed with a capital of £12,000,000 for the purpose of dealing with the financial side of the Diamond Corporation's business.

Anglo American is closely interested in Northern Rhodesian copper mining directly through its investments, and indirectly through Rhodesian Anglo American Ltd. which controls Rhokana Corporation (an article on which appears on page 213).

In April 1953 it was announced that the Corporation has taken over all the duties and responsibilities of Managers, Consulting Engineers and Buyers for Wankie Colliery Co. Ltd., thereby obtaining control of the sole source of coal for Southern and Northern Rhodesia. Wankie is established on an enormous coalfield, with immense reserves of coal.

Coal interests in the Transvaal are spread over some of the most promising collieries and are held through the medium of African and European Investment Co., and its associated company, Vereeniging Estates Ltd. whose activities feature on page 185.

FAR EASTERN AND WESTERN RAND MINING

The leading gold producers of the group are situated on the Far Eastern section of the Witwatersrand and comprise Brakpan Mines, Springs Mines, Daggafontein Mines, East Daggafontein and South African Lands. Well to the west of the Rand in the Klerksdorp district of the Transvaal it controls Vaal Reefs, and Western Reefs, which company, together with Daggafontein, are included amongst the mines scheduled to produce uranium.

Through its predominating holding in West Rand Investment Trust the corporation has an indirect interest in the five mines working on the "West Wits line"—Blyvoor, Doornfontein, Libanon, Venterspost and West Driefontein. It is also interested in West Witwatersrand Areas and Western Ultra Deep Levels.

Operating and financial results for the Corporation's producing properties over the past two years are summarized in the tables at the foot of this page and the next.

From these figures it will be seen that the Corporation's Rand mines have again made satisfactory progress. The overall dividend distributions from these mines was maintained last year at a very satisfactory level from working profits and from additional revenue received from gold premium sales which helped materially in offsetting increased working costs, the upturn in which, however, was less pronounced than in the preceding year.

BRAKPAN AND SPRINGS MINES

Brakpan Mines, which was registered just fifty years ago, is situated in the centre of the Far Eastern Rand, surrounded by other rich producers. It has been a successful undertaking and is fully developed, but capital expenditure has still to be made in connection with shaft sinking and equipment.

Most of the ore in the eastern part of the property has been mined and supplies from the Witpoort section form the bulk of the tonnage sent to the mill. The wide footwall reefs underlying the Main Reef Leader have proved to be of much value, yielding good quantities of ore of a satisfactory grade. The irregularity of the pyritic bands in this deposit and the gold distribution in the ore have indicated a big difference between the value of payable development and that of the reserve tonnage.

The mill feed continues to be satisfactory with consistent monthly tonnages. Profits, however, have been eroded by the rising trend of working costs and, as a result, dividends have been on a lower scale.

In Springs Mines property, the payable area of the Kimberley reef horizon having been thoroughly explored, the Main Reef Leader is now relied upon as the principal ore carrier. Development therefore is practically confined to this reef and the future hinges upon the Vlakfontein area in the southern section.

It was for the purpose of opening up this part of the mine that the No. 5 shaft, brought into commission three years ago, was sunk. It is a large area and has yielded a good tonnage.

The feature which characterizes the mine is that the mill head grade is well below that of the ore reserves notwithstanding the fact that, with increased costs, an up-grading of the monthly throughput has had to be made. Profits have been affected and as a result, dividends have been on a lower scale.

SOUTH AFRICAN LAND AND EXPLORATION

The property of South African Land, situated between Springs and Brakpan, is being opened up in depth and giving good results. The major proportion of the work is being concentrated on the

MILLING AND DEVELOPMENT RESULTS FOR GROUP'S RAND PRODUCING MINES

Company	Year Ended Dec. 31	Milling Results			Results Per Ton			Development				Ore Reserves		
		Tons Milled (000)	Grade Milled (dwt.)	Oz. Yielded	Revenue s. d.	Cost s. d.	Profit s. d.	Footage Advanced	Footage Sampled	Per cent Payable	Average Value (in.-dwt.)	Tons (000)	Value (dwt.)	Width (in.)
Brakpan Mines	1951	1,375	3.8	258,755	49 2	37 4	11 9	71,013	54,845	27.2	519	3,965	4.59	43.33
	1952	1,419	3.6	254,856	45 11	38 10	7 1	71,603	52,580	28.3	555	3,925	4.66	43.91
Springs Mines	1951	2,004	2.6	261,108	34 1	28 9	5 4	40,586	33,530	33.7	395	4,026	4.32	43.56
	1952	1,954	2.6	258,739	33 11	30 6	3 5	34,984	29,945	36.9	346	3,327	4.37	43.51
S.A. Lands	1951	1,380	3.5	241,993	45 9	29 8	16 2	84,119	57,380	42.6	375	3,324	4.71	42.29
	1952	1,317	3.6	237,007	46 0	32 4	13 7	76,848	47,745	38.3	417	3,424	5.01	42.22
Daggafontein Mines	1951	2,810	4.9	688,377	63 11	24 2	39 10	60,132	47,800	45.1	350	14,430	5.73	43.78
	1952	2,788	4.7	663,046	60 10	25 11	34 11	65,047	51,470	46.2	400	13,982	5.73	44.29
East Daggafontein	1951	1,183	3.7	216,351	47 10	29 1	18 10	60,735	45,445	32.4	295	4,685	4.51	36.83
	1952	1,140	3.6	202,695	45 6	31 4	14 3	55,744	45,400	25.0	246	4,360	4.43	36.83
Western Reefs	1951	1,222	4.4	268,786	57 5	32 9	24 8	83,446	41,955	44.5	432	4,603	5.08	46.72
	1952	1,345	4.2	280,303	53 3	33 9	19 6	85,826	41,895	53.3	467	4,703	5.03	47.29

*Includes revenue from premium gold sales.

southern section where a shaft sinking programme was carried out a few years ago. Developments continue satisfactory and the grade of ore opening up is above the average of that being milled.

The mine has derived great benefit from its early lay-out and the capital expended on ventilation and other necessary shafts has been justified in every respect.

But the hindrance experienced in connection with shortage of electricity supplies has resulted in the crushing of a lower tonnage and costs have increased. Profits have consequently tapered and it has been necessary to pay smaller dividends.

DAGGAFONTEIN AND EAST DAGGAFONTEIN

At Daggafontein Mines, both the Main reef and the Kimberley continue to yield good quantities of ore with satisfactory payability. It was for the purpose of mining effectively the Kimberley reef that the North reduction plant was installed and No. 4 shaft sunk, calling for large capital expenditure which has now been completed. Release from the obligation of meeting this commitment has enabled the company to counteract any downward trend in dividends. But higher working costs have had to be met and monthly profits have been on a lower scale.

Grade of the ore milled continues to show a very comfortable margin in relation to the reserves which, notwithstanding the mine's thirty-seven years working, are well ahead of milling—though they are rather lower in volume in consequence of the up-grading of the ore owing to the higher level of working costs.

Similarly at East Daggafontein both the Main and Kimberley reefs are being developed, giving satisfactory pay ratios and values. It was as a result of satisfactory underground work and the building up of reserves that the reduction plant, which had an initial capacity of 60,000 tons a month was expanded to 100,000 tons. This monthly throughput has not been attained as neither the required labour supply nor sufficient power supplies have been available. Greatly increased demands on the Electricity Supply Commission has necessitated cuts and the mine has had to resort to Sunday working to make up for lost time.

As a result of the attenuated mill tonnage, profits have declined and the distribution to shareholders has had to be lowered. Working costs, however, have remained fairly consistent.

WESTERN REEFS AND VAAL REEFS

In the Klerksdorp area, Western Reefs has been mining the Elsburg series but now that the No. 3 sub-vertical shaft is completed, development on the Vaal reef will be started.

On the western side of the property the company is obtaining good results on farm Goedgenoe, which lies outside the present mining lease but rights are held over it under the Reserved Minerals Development Act. The reef in this direction is being explored by the extension of a haulage from level 26 of the existing mine, and values have been well above the present milling grade.

The completion of the sinking and the re-equipping of the sub-vertical shaft (undertaken jointly with Western Reefs) has brought Vaal Reefs to the development stage. It is intended to carry on with underground work in order to open up as much ore as possible preparatory to bringing the mine to production. This, however, will have to await the sinking of a further shaft.

The main objective of the work to be put in hand is to push out twin drives from the No. 3 shaft to the site of the new projected shaft and so enable the sub-vertical part to be sunk simultaneously with the vertical part that will be put down from the surface.

Mine expenditure is being financed by a loan from the Anglo American Corporation. The company is interested in the new neighbouring Hartebeestfontein Gold Mining as it has ceded to that company certain claims on farm Zandpan and has undertaken to subscribe for shares in the initial capital.

ORANGE FREE STATE INTERESTS

The names of the Anglo American Corporation and of Sir Ernest Oppenheimer are pre-eminently associated with the transformation of the O.F.S. veld into a goldfield. In this new field no less than seven mines are being brought into existence under the aegis of the Anglo American Corporation, while it is directly or indirectly interested in most of the others. Side by side with the development of the mines under its control the corporation has been mainly responsible for providing the industrial and residential ancillaries necessary. These integral parts of the new field are reflected in the development both of Welkom and of the newer township of Allanridge, which lies to the north.

In addition to its direct shareholdings in the mines in the O.F.S. the corporation has further interests through its large investments in African & European Investment Co., South African Mines Selection and the Orange Free State Investment Trust. This latter trust originated from the hiving-off by Anglo American Corporation of the whole of its Free State interests, and it has built up a highly successful portfolio of mining shares encompassing practically every Orange Free State company. Furthermore, "Ofsits" has been able to enlarge its holdings by exercising its "rights" to new issues and the market value of its investments is well in excess of the latest balance sheet figure.

WELKOM GOLD MINING

Both mining and milling have continued on Welkom Gold and the company has successfully arranged for the provision of new money to repay loans to complete its capital expenditure programme and to provide for the planned extension of the plant capacity to 125,000 tons a month. The peak tonnage to date was reached last month when 63,000 tons were milled. The present capacity is 100,000 tons per month.

In the comprehensive finance scheme put forward towards the end of last year, an amount of £3,000,000 was raised, of which £2,500,000 of the amount was to repay loans. Half of the money was obtained by the sale of Welkom's holding in President Brand and President Steyn to the Anglo American Corporation, which also provided loan facilities for the balance at 6 per cent, repayable not earlier than 1957 but not later than December 31, 1962. In return the corporation was granted the right to subscribe for 1,000,000 Welkom shares at 30s. the capital so subscribed to be used in reduction of the loans, while any amount outstanding was to be protected by the issue of Unsecured Notes.

Among other items of news connected with this O.F.S. gold producer was its first ore reserve estimate. Hitherto, there had been no data on which to evaluate the company's expected tonnage or grade but at the end of 1952 the ore reserve figure was stated to be 974,200 tons, averaging 5 dwt. over a stoping width of 50 in., equivalent to 250 in.-dwt.

A milling grade of 5 dwt. per ton is entirely economic under present conditions and Welkom has the additional advantage that ore currently sent to the mill has not been mined from that part of its property where earlier probings indicated much richer ground.

Tonnage crushed in 1952 was 608,000 tons which yielded a revenue of £1,353,106. Working profit on mining was £15,139. The monthly tonnage throughput rose steadily until the middle of last year when a heavy inrush of water occurred on a development end in No. 1 shaft. Although this was effectively closed by cementation, development work was hampered and mine operations disrupted. In order to avoid a recurrence of this trouble the necessary precautions were taken and No. 2 shaft is being deepened and the two levels above the working horizon, where the trouble occurred, are being established, while the mine's pumping capacity is being increased. It is hoped to gradually increase the number of stope faces available and to add to the flexibility of mining operations.

FINANCIAL RESULTS FOR GROUP'S RAND PRODUCING MINES

Company	Year Ended Dec. 31	Working Profit	Premium	Revenue	Sundry Revenue	Sundry Expenses	Taxation and Govt. Share of Profit	Net Profit after Tax, etc.	Capital Expenditure Reserve	Dividend		Balance Unappropriated	Issued Capital	
		Excluding Gold Premium	Gold Sales	from Shareholdings						Total	Per Share		Total	Share Unit
		£	£	£	£	£	£	£	£	£	s. d.	£	£	s. d.
Brakpan Mines	1951	651,820	159,075	80,074	8,654	2,777	392,321	504,525	51,352	488,750	2 1½	153,373	1,150,000	5 0
	1952	424,502	80,565	69,018	4,943	2,184	177,074	—	316,250	316,250	1 4½	186,529	1,150,000	5 0
Springs Mines	1951	373,916	160,473	1,447	6,383	2,486	105,553	434,180	39,194	379,125	0 9	261,109	2,527,500	5 0
	1952	249,375	84,467	2,001	4,725	1,772	21,529	—	—	—	0 6	317,566	2,527,500	5 0
S.A. Lands	1951	964,429	149,713	402	7,677	1,890	525,472	594,859	40,998	525,938	4 3	145,189	433,125	3 6
	1952	822,456	72,735	1,494	7,133	1,472	401,387	500,959	28,252	433,125	3 6	172,807	433,125	3 6
Daggafontein Mines	1951	5,177,623	415,119	64,111	28,877	4,410	3,290,278	2,391,042	281,953	2,100,000	6 0	241,586	1,750,000	5 0
	1952	4,661,109	208,292	51,341	31,019	3,291	2,264,604	2,683,867	83,630	2,100,000	6 0	311,885	1,750,000	5 0
East Daggafontein	1951	977,608	134,226	971	4,173	2,044	564,614	550,320	39,641	512,875	2 9	180,614	1,865,000	10 0
	1952	746,088	66,676	668	4,211	1,502	387,637	428,504	5,666	396,313	2 1½	196,355	1,865,000	10 0
Western Reefs	1951	1,345,280	159,900	1,354	19,229	4,881	469,472	1,051,410	216,040	859,375	2 6	262,456	1,718,750	5 0
	1952	1,226,707	84,023	1,397	15,595	1,785	—	1,325,937	220,409	875,000	2 6	280,458	1,718,750	5 0



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THE TWO PRESIDENTS

In the comprehensive financial scheme evolved in connection with both Welkom and President Steyn, an amount of £4,000,000 was estimated to be required for an accelerated development and production programme. In the case of President Steyn, the whole of this capital is to be provided by the Anglo American Corporation by way of loans at 6 per cent, of which not less than one half will be repayable in 1957 and the balance by the end of 1962, subject to any reduction by virtue of the corporation exercising its option to subscribe for 2,000,000 President Steyn shares at 20s. at any time up to mid-1955. After this date the issue of Unsecured Notes for the amount of loan can be called for.

At the company's mine the reduction plant with a capacity of 50,000 tons per month was completed towards the end of last year, since when a small tonnage of development rock has been milled in order to carry out metallurgical tests. It has been decided to increase the capacity of the plant to 125,000 tons per month and work on the extensions is proceeding satisfactorily. It is hoped that the monthly tonnage milled will reach 50,000 tons at the end of the current year.

The Basal reef was intersected in No. 2 shaft in April of last year and the shaft has been completed to its final depth of 5,074 ft. During the March quarter, 1953, 165 ft. of driving on the Basal reef on the 4,800 ft. level was accomplished and 66.67 per cent proved payable averaging 66.24 dwt. over 5.95 in., equivalent to 394 in.-dwt. The "A" reef, which lies about 650 ft. above the Basal reef was intersected on two levels, and during the March quarter 515 ft. were sampled giving a pay ratio of 92.23 per cent averaging 10.35 dwt. over 62.24 in., equivalent to 644 in.-dwt.

Although it is too early to estimate the tonnage available from the "A" reef, the results achieved are most encouraging and indicate that the so-called subsidiary reefs in the Orange Free State may prove to be a valuable additional source of revenue.

Up to the end of March this year a total of 45,064 ft. of development had been accomplished from both the No. 1 and No. 2 shafts on the property. 5,919 ft. remained to be accomplished to effect a connection between the two shafts. It is hoped that ore from stoping operations will be available to enable the mine to come into production in the last quarter of 1953.

The capital scheme in which the President Brand mine participated provided it with an amount of £5,500,000. Of this sum, £2,406,250 was raised by the issue of 2,750,000 reserve shares of 5s. each at 17s. 6d., and a further £3,093,750 in April 1954, by the exercise of option certificates in respect of another 2,750,000 shares granted to subscribers of the issue at 22s. 6d. on a one for one basis. The offer to shareholders was 2,500,000 shares in the proportion of one for three; the remaining 250,000 being subscribed by Anglo American Corporation, who underwrote the issue and agreed to lend the company any money it required at 6 per cent up to the end of April 1954, the last day on which the options can be exercised.

During 1952, work on the two shafts of the property was continued; and since then further progress has been made. No. 1 has reached its final depth of 4,879 ft. and underground development has commenced on four separate levels. At the end of March last, No. 2 shaft had reached a depth of 4,468 ft. This shaft will be stopped at 4,840 ft. and, at a later date, a sub-vertical shaft will be sunk from the 4,600 ft. level to open up the reef in the southern portion of the mine. It is estimated that a connection between the shafts on the 4,600 ft. level will be completed towards the middle of 1954. Development from No. 2 shaft is scheduled to start in the third quarter of 1953.

Work on the reduction plant has proceeded and it is hoped that it will be started for metallurgical and test purposes early in 1954, while production will start shortly afterwards. The capacity is 75,000 tons and it has been decided to increase this to 125,000 tons; the extension has already been ordered.

WESTERN HOLDINGS

A very interesting phase has been reached in the position of this company. Developments started early last year and a fair amount of work in opening up the Basal reef has been accomplished—most of it from No. 2 shaft in the southern part of the property. The other shaft is about a mile-and-a-half away to the north and one of the objectives is to connect the two shafts underground in order that work can be expedited.

Underground development footage last year was most satisfactory. Although the intersection of water-bearing fissures retarded this work, by the end of March last year, a total of 49,746 ft. has been driven. Of the 7,280 ft. developed on the Basal reef, 7,155 ft. were sampled and 93.08 per cent proved payable, averaging 107.87 dwt. over 6.12 in. 660 in.-dwt.).

The footwall drive from No. 1 shaft towards the northern boundary has advanced 1,983 ft. since it started last year. Approximately 3,021 ft. remain to be driven before it reaches the boundary at which point it will be turned to pick up the reef and connect with the drive in the Free State Geduld property. This is expected to eventuate in the last quarter of the current year.

The mine is scheduled to start production in the middle of the current year and it is expected that milling will increase

gradually until 75,000 tons per month is reached. This is the present capacity of the plant but it is being extended to treat 125,000 tons a month and work on the extension is already in hand. Actual operation of the plant for metallurgical and test purposes started last year on diluted ore from development. It is hoped that very shortly now, rock will be sent to the mill from stoping and that a small working profit may be declared in July.

In addition, Western Holdings has a portfolio including shares in both Presidents, St. Helena, Welkom and Jeannette.

FREE STATE GEDULD

Both shafts on the property of Free State Geduld intersected the Basal reef during 1952. No. 1 shaft reached its final depth of 5,517 ft. and is being equipped. Development is scheduled to start and it is hoped that a small footage will be accomplished during the second quarter of the current year.

Operations in No. 2 shaft have been greatly hindered by the serious water troubles which occurred last year. The inrush of water could not be brought under control by the ordinary cementation methods owing to the friability of the shaft walls. Accordingly, a concrete plug was inserted in the shaftbottom and while it was being allowed to consolidate, development was started from the 5,350 ft. level. A serious inrush of water then occurred in one of the development ends and could not be dealt with by pumping and baling. Cementation ranges were inserted in the development ends and to provide against further inrushes a thick concrete plug was also inserted.

It is proposed to develop from the 5,150 ft. level and, at a later date, to sink an incline to the 5,350 ft. level to connect with the drive from the No. 1 shaft. The technical advisers are confident that the water in the fissure can be effectively sealed and that future development operations will not be unduly affected.

Work on the reduction plant has continued satisfactorily and it is proposed that the mill should operate on a small scale for metallurgical and plant test purposes, using development rock, during the last quarter of this year. Capacity is being increased to 125,000 tons per month.

The company offered 1,000,000 reserve shares to shareholders last year at 45s. with options to take up further shares at 55s. The water difficulties experienced strained the company's resources and it is now necessary to resort to loans from Anglo American.

LORAINÉ AND JEANNETTE

Two shafts are being sunk on both the Loraine Gold and Jeannette Gold properties.

The No. 1 shaft of Loraine intersected the Basal reef at a depth of 4,805 ft. below the collar in September 1952. The reef exposed was sampled at 5 ft. intervals around the perimeter and the eleven sections sampled gave an average value of 65.61 dwt. over a channel width of 5.33 in., equivalent to 350 in.-dwt.

At the end of March last, No. 2 shaft, which is to be sunk to a final depth of 5,450 ft., had reached 4,334 ft. The "B" reef, which is about 650 ft. above the Basal reef horizon, was intersected at 4,156 ft. and sixteen sections sampled gave a value of 13.2 dwt. over 26.4 in. 75 per cent proved payable. The Basal reef is estimated to be at a depth of 4,800 ft.

Work on the reduction plant with a capacity of 75,000 tons per month has proceeded satisfactorily and provision has been made for the extensions necessary to increase it to 100,000 tons.

During the year arrangements were made to finance Loraine and the Anglo American Corporation agreed to subscribe at par for £5,500,000 Registered 6 per cent Unsecured Notes in two blocks—£3,500,000 in the early part of this year and £2,000,000 on January 1, 1954. Under the proposals, the corporation was granted free of consideration, options exercisable up to January 31, 1955, at 12s. 6d. per share for 100 Loraine shares for each £100 notes subscribed. The notes are redeemable at any time at 102½ per cent, on 90 days' notice, and any notes outstanding on August 31, 1962, will be redeemable over the succeeding four years.

Financing is also being arranged for Jeannette Gold by Wit Extensions and Anglo American Corporation. Work on this company's property is proceeding; shafts are being sunk and preparations made for the plant.

URANIUM CONTRACTS

In common with other South African gold mining groups, several Anglo American mines stand to benefit considerably from the Union Government's policy of awarding contracts for the production of uranium backed by the loan of the necessary capital for the erection of treatment plants. Of the Corporation's Rand producers, Daggafontein Mines and Western Reefs are in the process of erecting extraction plants, while in the O.F.S. five Anglo American mines are scheduled for uranium production—namely Welkom, both Presidents, Western Holdings and F. S. Geduld. Two treatment plants, scheduled for completion towards the end of 1954, are being erected on the properties of Welkom and President Steyn and they will jointly handle the slimes from all five mines.



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African & European Investment Co. Ltd.

THIS firmly established mining-finance house was formed in 1904 to acquire a participation in the Rand gold mining industry and to carry on an investment business as well as to engage in farming and real estate operations. Since coming under the technical control of the Anglo American Corporation of South Africa, the company's fortunes have come to be based on considerably wider and more substantial foundations and it now holds a strong portfolio of assets in Rand and Orange Free State companies, town properties, participation rights and mineral interests. This impressive spread of assets is, of course, additional to its important function of managing Anglo American's appreciable colliery interests. Further, it owns arable lands of some 8,000 acres, which it has cultivated by modern mechanical farming methods and engages in ranching and in the production of foodstuffs.

O.F.S. VENTURES AND SHARE INTERESTS

The company was one of the early venturers into the Orange Free State and its name became associated with what was, at one time, called Block 7. In co-operation with the Anglo American Corporation and other interests this large area was tested by boreholes and it was subsequently agreed that the western portion should be developed by separate interests. This resulted in the formation of Welkom Gold, President Brand and President Steyn, in all of which African and European has substantial shareholdings.

It has retained the balance of this large area—the eastern, northern and central parts and has continued to carry out exploratory work. The ground has given evidence of value, while interesting disclosures have been made by New Consolidated Gold Fields and Union Free State Mining on farms contiguous to those held by the company. These farms include Homestead, Saaipias, La Riviera and Harmony. New Consolidated Gold Fields have met with very encouraging results from its drilling programme and there is the probability of another gold mining company being floated to work a large and potentially valuable area.

In addition to its shareholdings as vendors, the company has broadened its portfolio by acquiring shares in other O.F.S. companies, including Orange Free State Investment Trust, O.F.S. Land and Estate, St. Helena and Lydenburg Estates. Hence it is seen that the company is well entrenched in this new African goldfield, which gives promise of more than making up for the waning production of the Witwatersrand.

LYDENBURG ESTATES LTD.

An undertaking in which the company has held an interest for many years is Lydenburg Estates. This is a London-registered company which, like African & European, has broadened its interests. It was formed originally to acquire options and mineral rights in the Eastern Transvaal and the Orange Free State. These have matured into share participations in several companies operating in this new goldfield including Welkom, President Brand, President Steyn, Virginia and Merriespruit. In addition the company has its interest in large areas of ground, mineral and participation rights.

Lydenburg has leased to Munnik Myburg Chrysotile Asbestos Ltd. the right to mine asbestos on its farm Joubertsdal, and receives in return a royalty on all asbestos obtained. The undertaking has been producing well and there is the promise of it attaining its milling target of 4,000 tons per month. If this comes about it should reward the company well and constitute a supplementary income to that which may be expected when the various O.F.S. mines reach the dividend paying stage.

At the end of 1952 investments in Lydenburg's balance sheet stood at £235,477, nearly all of which were quoted and had a market value of £409,579 at that date.

COLLIERY INTERESTS

The prescience which the company showed in the early days of its career in becoming interested in the South African coal mining industry has been amply rewarded. Its holdings in collieries consist of both coal rights over an area of 176,903 acres and of large shareholdings. These holdings are principally held through the medium of its associated company Vereeniging Estates Ltd. which has four colliery interests, Amalgamated Collieries of South Africa, The Coronation Collieries, Springbok Colliery and South African Coal Estates.

These collieries, which are under the administration of African & European, made a particularly good showing during their last financial year. South African Coal Estates paid a dividend of 20 per cent from profits derived from 1,641,706 tons of coal

produced; Amalgamated Collieries output was 7,864,140 tons of which 75 per cent was sold to the Electricity Supply Commission in South Africa for power station purposes. The company's dividend was increased by 2½ per cent to 17½ per cent. Output from Coronation Collieries and its subsidiary are dependent upon the railway transport but the company last year was able to over-ride all difficulties and to step up its dividend from 27½ per cent to 35 per cent.

Additionally, Vereeniging Estates owns the entire issued capital of the Transvaal Coal Corporation. This undertaking owns the coal rights over an extensive field of good quality coal in the Eastern Witbank coalfield, having an approximate area of 12,700 morgen and estimated to contain millions of tons of good quality coal.

A further stake in the coal industry is represented by its interest in the New Largo Colliery Ltd. which has been supplying the bulk of Escom's supplies. Largo is coming to the end of its productive life and a new pit is about to be established. Drilling on the field in the Kendal area, to be leased from Witbank Coal Holdings and African & European Investment, has given evidence of a very large tonnage, estimated at 80,000,000 tons of extractable medium-grade coal.

Outside its colliery interests, Vereeniging Estates has land, mineral and industrial interests, the latter consisting principally of a substantial shareholding in Vereeniging Brick & Tile Co. This company has built up a valuable business manufacturing refractories, salt glazed sewer pipes and fittings, building bricks and other earthenware products. It also has a subsidiary, Rhodesian Refractories, which manufactures certain types of refractory bricks.

During 1952 Vereeniging Brick & Tile made a profit of £487,688 and distributed 20 per cent in dividends. The demand for the company's wide range of ceramic-ware remains high and new capital has been invested in the business to meet its expanding capacity.

DIVERSE INTERESTS

For many years African & European has been interested in asbestos through the medium of royalties earned on amosite mined by Amosa Ltd., a subsidiary of Cape Asbestos Ltd., on certain of the company's farms in the Lydenburg district.

Amosa Ltd. has successfully developed a large market for amosite in the insulation trade, particularly in the United Kingdom, the U.S., and in Australia, and with the growth of this trade it is likely that African & European's royalties from amosite will, in the years ahead, form a greater proportion of its revenue.

In this connection an agreement has been made with Amosa Ltd. under the terms of which that company will enjoy greater security of tenure and African & European will receive larger royalties.

The remarkable post-war growth in the demand for asbestos for numerous industrial uses has induced the company to extend its interests in this field. Canada is by far the largest producer of asbestos in the western world and the bulk of her production is of the shorter fibre grades. On the other hand, Southern Africa, including the Rhodesias, is well placed in regard to spinning fibres. African & European, therefore, decided to confine their investment in asbestos to those mines producing a high percentage of fibre within the range of certain grades and accordingly the company acquired interests in Munnik Myburg Chrysotile Asbestos and in Rhodesia Montelleo Asbestos.

African & European also has a shareholding in the Union Steel Corporation of South Africa. This undertaking, formed some forty years ago, has made excellent progress and it owes much to the encouragement of the late General Smuts. The company's profits last year amounted to £770,879 against £804,000 and dividend distributions were 15 per cent and a bonus of 5 per cent on both Ordinary and Preference shares.

* FINANCIAL RESULTS FOR 1952

From the widespread interests of the Company, substantial revenue is derived as the results for 1952 show. The total income amounted to £1,080,423, compared with £977,654 previously, and included income from dividends, share transactions, sale of farms, mineral interests, etc. Apart from real estate, mineral rights, etc., which had a book value of £208,339, the principal assets of the company are its investments, amounting in total to £8,098,301. Quoted investments appear in the balance sheet at £7,367,150, the market value at December 31, 1952, being £10,776,909. The ordinary dividend was 2s. 6d. per 10s. stock unit, which was the same as paid for the previous year.

The Central Mining & Investment Corp. Ltd.

THE Central Mining Rand Mines Group is often referred to as the "Corner House Group," a title attributed to the address of one of its founders—Herman Eckstein—whose office in Johannesburg in 1888 was located in the Corner House, which at that date, was the only two-storeyed building in existence there. Located on the original site, but rebuilt in 1904, the Corner House remains the address of the Group in Johannesburg.

The "Group" is responsible for the technical and administrative control of 11 producing gold mines situated in the Transvaal and one developing company in the Orange Free State, and also certain important land, coal and industrial undertakings. An analysis of the Group's interests is shown in the list that follows:

Gold Mining: Blyvooruitzicht Gold Mining Co. Ltd.; City Deep Ltd.; Consolidated Main Reef Mines & Estate Ltd.; Crown Mines Ltd.; Durban Roodepoort Deep Ltd.; East Rand Proprietary Mines Ltd.; Harmony Gold Mining Co. Ltd.; Modderfontein B. Gold Mines Ltd.; Modderfontein East Ltd.; Rose Deep Ltd.; Transvaal Gold Mining Estates Ltd.; Welgedacht Exploration Co. Ltd.

Mining & Finance: Central Mining Free State Areas Ltd.; Rand Mines Ltd.

Coal Mining: Witbank Colliery Ltd.

Industrial: The Hume Pipe Co. (South Africa) Ltd.; Northern Lime Co. Ltd.; Pretoria Portland Cement Co. Ltd.; S.A. Forest Investments (Proprietary) Ltd.; Transvaal Consolidated Land & Exploration Co. Ltd.

In addition to their shareholdings in the "Group" companies both the Central Mining and Rand Mines have a considerable interest in other gold mining and industrial companies in South Africa and in the exploration and development of the Orange Free State goldfield.

Outside South Africa the major interest of the Corporation is in the oil industry through its association with Trinidad Leaseholds Ltd.

Some of the interests of the Group are dealt with later in this article under separate paragraphs and comparative statistical tables are to be found at the foot of these pages relating to the Group's "Dividend paying" gold producers.

Throughout 1952 the gold mining industry was considerably handicapped on account of a shortage of both labour and electric power. Compared with the previous year there was yet again a considerable increase in working costs; also the additional revenue derived from sales of gold at a premium fell severely. These two factors resulted in greatly curtailed working profits which for the Transvaal amounted to £42,367,000 as against £51,072,000 in 1951.

Towards the close of 1952 the first uranium recovery plant at the property of the West Rand Consolidated, came into operation. So far 15 mines have been selected to produce this mineral, of which two belong to the "Corner House Group" (Blyvooruitzicht and Harmony). Four mines—Blyvooruitzicht, Daggafontein, Western Reefs and Stilfontein—are scheduled to reach the production stage during the course of the current year. The annual gross revenue from the recovery of this mineral, when full production has been reached, has recently been quoted by the South African Prime Minister at a figure of the order of £30,000,000. For comparative purposes the revenue from gold production in 1952

from both the Transvaal and the Orange Free State was slightly under £145,000,000.

Steady progress was made in the development of the Orange Free State goldfield where two mines have been in operation since November 1951. The current year may see five further mines reaching the production stage.

BLYVOORUITZICHT GOLD MINING CO. LTD.

During the financial year ended on June 30, 1952 the working profit reached a record total of £7,695,000. Although there was a slight improvement in the strength of the labour supply this was still far short of the company's requirements and in consequence operations were at a level considerably below capacity. Operations during the current financial year have been further hampered by a severe drop in the number of non-Europeans in service.

In order to mine more closely to the grade of the available ore reserves, the proportion of the tonnage taken from the lower grade blocks in the western area of the mine, was increased resulting in a steady fall in yield. This falling off in recovery was the main cause of the decrease in the working revenue equivalent to 20s. per ton milled.

This company is erecting a plant to extract uranium from the residue slimes of its gold production plant. The capital cost of this plant is estimated at £3,358,000. The whole of this amount will be provided by means of loans arranged through the Atomic Energy Board of South Africa. It is anticipated that the plant will be in operation early in 1953. Taxation in regard to uranium production is on the same basis and formula as that applicable to gold mining and as the profits from the two sources will be taxed conjointly, the capital expenditure on the uranium plant has brought about an immediate increase in the redemption allowance. This benefit will, however, diminish as the unamortized balance is reduced and the company will in time be faced with increased taxation and lease consideration as its taxable profit increases.

DURBAN ROODEPOORT DEEP, LTD.

The tonnage milled increased by 18,000 tons and development by 1,319 ft. compared with the previous year. The shortage of both power and labour is, however, seriously affecting operations. In conformity with the rest of the mining industry, working costs at the mine continued their persistent upward trend, being 1s. 10d. per ton milled higher than for the previous year. In general there was some improvement in the overall development results compared with the previous year but the increase in the quantity of ore developed was more than offset by the tonnage lost to reserves due to the higher pay limit. Development on the Kimberley Reef continued to give encouraging results and it is intended to expand the scale of operations on this reef. This should have a beneficial effect on working costs but it may, however, lead to a slight reduction in the grade of ore milled.

CROWN MINES LTD.

In its time this company has been one of the greatest gold mines of South Africa and it is still one of the best known. The peak of its gold producing and profit earning capacity was reached a number of years ago, however, and since that time the fortunes of the mine have declined gradually but inexorably. Recently the severe increase in working costs which has taken place throughout the

MILLING AND DEVELOPMENT RESULTS FOR GROUP'S PRINCIPAL RAND PRODUCERS

Company	Year Ended	Milling Results			Results Per Ton			Development				Ore Reserves		
		Tons Milled (000)	Grade Milled (dwt.)	Oz. Yielded	Revenue s. d.	Cost s. d.	Profit s. d.	Footage Advanced	Footage Sampled	Per cent Payable	Value (in. dwt.)	Tons (000)	Value (dwt.)	Width (in.)
Blyvoor	June 1951	1,093	14.13	772,268	183 2	45 5	137 9	41,056	20,620	97.9	606	5,517	13.0	46.2
	June 1952	1,298	12.62	819,176	163 2	44 7	118 7	41,463	14,625	94.9	588	5,527	12.5	46.4
City	Dec. 1951	1,955	4.04	394,834	52 9	41 11	10 10	54,883	25,155	32.8	327	5,434	5.8	42.6
	Dec. 1952	1,851	4.06	375,759	52 0	47 3	4 9	50,880	23,700	32.3	299	5,397	5.7	43.3
Cons. M.R.	June 1951	2,261	2.70	305,179	34 11	28 1	6 10	48,219	34,510	46.8	213	5,094	3.3	53.5
	June 1952	2,283	2.74	312,352	35 4	29 8	5 8	45,259	32,730	48.3	228	4,337	3.4	53.6
Crown	Dec. 1951	3,242	3.41	552,878	44 7	35 10	8 9	113,426	61,445	48.7	245	9,044	4.3	48.1
	Dec. 1952	3,253	3.19	518,164	40 9	36 9	4 0	88,995	56,380	51.8	330	8,635	4.3	48.2
Durban	Dec. 1951	2,150	3.44	370,018	45 0	31 9	13 3	79,921	42,230	57.8	313	8,548	4.2	60.7
	Dec. 1952	2,168	3.44	372,333	44 0	33 7	10 5	81,240	46,380	65.1	307	7,988	4.2	59.5
E.R.P.M.	Dec. 1951	2,624	4.09	537,090	53 6	34 11	18 7	52,822	16,190	67.8	459	6,943	5.1	48.6
	Dec. 1952	2,451	4.31	528,653	55 3	40 0	15 3	54,771	16,340	68.2	394	6,051	5.7	46.8
Modder East	June 1951	1,457	2.39	174,225	31 0	21 9	9 3	13,047	11,270	30.0	156	3,414	3.1	43.6
	June 1952	1,409	2.35	165,656	30 7	24 6	6 1	15,235	12,205	19.9	182	2,646	3.1	43.8
Rose	Dec. 1951	993	2.82	140,001	36 11	30 3	6 8	39,519	27,990	36.4	302	2,083	3.5	58.8
	Dec. 1952	983	2.80	137,705	35 10	32 8	3 2	45,081	31,160	38.0	327	1,545	3.6	59.2

gold mining industry, together with the serious shortage of native labour and such local difficulties as the big strike dyke and a general falling off in the mine grade, have combined to accentuate sharply the waning prosperity of this company.

EAST RAND PROPRIETARY MINES LTD.

The programme for extending the mine in depth has progressed satisfactorily throughout the year. The sinking of the south-east vertical shaft to its final depth was completed and the preliminary work on the headgear portion of the south-east sub-vertical shaft, together with the necessary connecting haulages, has been well advanced. The central sub-vertical shaft was sunk to its final depth of 9,637 ft. below the surface. Incline shaft sinking has made good progress and the values disclosed in the advance winzes continue to be satisfactory. While it has been possible to keep up to schedule with the shaft sinking programme as a result of special allowances of non-European labour for this class of work, the serious shortage of labour is having an adverse effect on normal development and production at the mine. Any further decrease in the supply of non-European labour must cause a reduction in the tonnage of ore milled. The decrease of 892,000 tons in the available ore reserve to 6,051,000 tons at December 31, 1952, was largely due to the increase in the pay limit which was necessitated by the continuing rise in working costs.

CENTRAL MINING FREE STATE AREAS LTD.

This company's most important interest is in Harmony Gold Mining Co. Ltd., which is referred to in a separate paragraph. In January 1953 Union Free State Coal & Gold Mines Ltd. went into liquidation and is distributing in May 1953 its large shareholding in the Harmony Co. on the basis of two Harmony shares for every five Coal & Gold shares. Based on its holding of Coal & Gold at the end of June 1952, the company will receive by way of liquidation distribution, 1,004,000 Harmony shares which added to its direct holding on the same date of 823,000 shares gives the company a stake of 1,827,000 shares in the Harmony Co. representing an interest of just over 13 per cent of the issued capital of 13,600,000 shares.

This company also has a 10 per cent interest in the New Consolidated, Free State, Exploration Co. Ltd., which has a considerable interest in the farms Saaiplaas Nos. 551 and 690, which lie immediately to the north of the Harmony lease area. The results of the drilling in this area have been encouraging and the way is now open to apply in due course for a mining lease. New Consolidated, Free State also has a substantial holding in the Harmony Co. and thus through this channel Central Mining Free State Areas has a further though indirect interest in the fortunes of the Harmony mine.

The capitalization of the company is:

Authorized: £5,000,000 in 20,000,000 5s. shares.
Issued: £3,000,000 in 12,000,000 5s. shares.

HARMONY GOLD MINING CO. LTD.

This company was formed in the latter part of 1950 to take over the proposed Harmony lease area and the exploitation thereof from Union Free State Coal & Gold Mines Ltd.

The initial financing of operations at the Harmony property was undertaken by the Coal & Gold Co. up to the end of January 1951 when the Harmony Co. took over operations on its own behalf and refunded the expenditure incurred to the Coal & Gold Co. out of the proceeds of a capital issue of £2,000,000 in 8,000,000

shares of 5s. at par. Subsequent expenditure was financed by means of temporary loan facilities provided by associated companies. In March 1952 the company raised £5,180,000 by an issue of 5,600,000 5s. shares at 18s. 6d. per share. The issue of shares was offered to:

- Harmony shareholders (other than Central Mining Free State Areas and New Consolidated, Free State, Exploration Co.) in the proportion of 7 for 10;
- Central Mining Free State Areas Ltd. shareholders in the proportion of 1 for 20;
- New Consolidated, Free State, Exploration Co. Ltd. shareholders in the proportion of 15 for 44,

and was underwritten by the Central Mining & Investment Corporation Ltd. The issue was subscribed for to the extent of 97 per cent. The temporary loans were repaid and at the end of October 1952 the company had a net cash balance of £2,130,000. It is expected that this amount should be sufficient to finance operations into the second half of 1953. Further financial arrangements will then have to be made to bring the mine to the production stage. By then several thousand feet of development on the Basal Reef horizon should have been completed which should provide a good indication of the values and percentage payability likely to be encountered in the neighbourhood of the ventilation shaft where mining operations will be concentrated during the early years of production.

In July 1952 the ventilation shaft intersected the Basal Reef at a depth of 4,364 ft. below the collar. Sampling at 5 ft. intervals round the perimeter of the shaft gave an average value of 10.08 dwt. over a channel width of 47.4 in., equivalent to 478 in.-dwt. The Basal Reef was stoped out for a distance of approximately 15 ft. round the shaft to facilitate the removal at a later date of the shaft pillar. The resulting reef face was sampled at 5 ft. intervals, the average value being 15.4 dwt. over a channel width of 45.6 in. equivalent to 702 in.-dwt. Seventeen sections of Basal Reef were sampled in the shaft, while a further 35 were sampled on the face of the stoped out area. Of the total of 52 sections, only one gave an unpayable result. The consistency of good values, together with the robust appearance of the reef, are encouraging features. The shaft has been sunk to its final depth of 4,730 ft. and a haulage level to No. 3 shaft is expected to intersect the Basal Reef shortly. A new borehole, L.R. 8, was drilled to determine the nature of the strata in the area where a second hoisting shaft may be sunk in due course. This borehole intersected the Basal Reef at a depth of 5,044 ft. and in spite of some loss of core due to grinding, the assay results of the original intersection and three deflections averaged 1,671 in.-dwt. Work on the surface is progressing satisfactorily and permanent accommodation for both Europeans and Non-Europeans is being extended rapidly. The excavations and foundations for the first 45,000 tons unit of the reduction plant have been started and work on the plant is being pressed forward steadily with the object of completing it during the first half of 1954 so that, given favourable conditions, milling may commence in the latter part of that year.

By arrangement with the Atomic Energy Board of South Africa the company announced in January 1953 that it is erecting a plant for the extraction of uranium from the residue slimes of its gold production plant. It is estimated that this will be ready for production during the latter half of 1954, when it is expected that gold production will commence.

The capitalization of the company is:—

Authorised: £3,750,000 in 15,000,000 5s. shares.
Issued: £3,400,000 in 13,600,000 5s. shares.

FINANCIAL RESULTS FOR GROUP'S PRINCIPAL RAND PRODUCERS

Company	Year Ended	Working Profit Excluding Gold Premium £	Premium Gold Sales £	Revenue from Shareholdings £	Sundry Revenue £	Sundry Expenses £	Taxation and Govt. Share of Profit £	Net Profit after Tax, etc. £	Capital Expenditure £	Dividend		Balance Unappropriated £	Issued Capital	
										Total £	Per Share s. d.		Total £	Share Unit s. d.
Blyvoor	June 1951	7,140,911	385,738	66,619	—	28,665	3,930,352	3,634,251	891,422	3,200,000	2 8	943,889	3,000,000	2 6
	June 1952	7,328,153	367,166	67,335	—	28,626	4,025,290	3,708,738	290,191	3,400,000	2 10	1,252,788	3,000,000	2 6
City	Dec. 1951	817,293	239,612	22,022	14,511	3,400	291,231	798,807	39,464	557,379	5 6	867,124	2,026,832	20 0
	Dec. 1952	318,380	119,121	21,467	10,685	3,113	9,319	457,221	264,652	253,354	2 6	806,370	2,026,832	20 0
Cons. MR.	June 1951	620,930	146,654	16,937	9,407	28,073	280,184	485,671	—	467,851	7 6	451,940	1,247,602	20 0
	June 1952	501,528	144,764	16,118	5,575	51,837	179,980	436,168	10,108	389,876	6 3	488,128	1,247,602	20 0
Crown	Dec. 1951	1,081,953	339,511	27,831	8,652	7,813	419,836	1,030,298	80,724	943,063	10 0	1,166,964	943,063	10 0
	Dec. 1952	484,991	163,682	28,620	25,100	6,600	9,320	686,473	165,752	471,531	5 0	1,216,183	943,063	10 0
Durban	Dec. 1951	1,201,228	227,456	18,361	2,587	35,781	456,801	957,050	234,162	581,250	5 0	867,085	1,162,500	10 0
	Dec. 1952	1,013,961	116,140	22,073	2,848	38,852	296,696	819,474	363,590	523,125	4 6	799,807	1,162,500	10 0
E.R.P.M.	Dec. 1951	2,106,840	331,240	28,745	14,490	33,071	869,775	1,578,469	500,000	990,000	5 0	849,666	1,980,000	10 0
	Dec. 1952	1,704,674	166,122	32,545	1,577	24,591	495,589	1,384,738	226,351	990,000	5 0	1,018,089	1,980,000	10 0
Modder East	June 1951	587,422	83,109	10,275	4,876	11,051	335,772	338,859	—	325,782	7 0	200,981	930,805	20 0
	June 1952	350,598	75,762	8,287	8,838	21,302	174,278	247,905	—	209,431	4 6	239,425	930,805	20 0
Rose	Dec. 1951	242,769	86,372	6,180	10,008	2,462	117,933	224,934	3,842	183,750	5 3	197,121	700,000	20 0
	Dec. 1952	115,978	41,522	6,867	11,328	2,347	22,396	150,952	5,510	105,000	3 0	237,524	700,000	20 0

*Includes silicosis liabilities.

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COLLIERY INTERESTS

Van Dyk's Drift Colliery (owned and operated by Transvaal Consolidated Land & Exploration Co. Ltd.). This colliery is situated in the Witbank district of the Transvaal and commenced operations on a full scale at the end of 1948. The following figures represent the tonnages despatched and the working profit earned for the years 1949, 1950, 1951, 1952.

	Tons Despatched (000)	Working Profit (£000)
1949.....	594	103
1950.....	585	102
1951.....	561	80
1952.....	557	100

A continuance of the inadequate supply of railway trucks was responsible for keeping the tonnage despatched at approximately the level of the previous year. The higher working profit achieved was largely due to the company receiving the benefit for a full year of the increased maximum price for the inland market, which came into effect in June, 1952.

Witbank Colliery Ltd.—Throughout the year to August 31, 1952, production continued to be restricted by inadequate and erratic supplies of railway trucks, and by the Government's embargo on coal exports. The tonnage of coal despatched at 1,416,000 tons, however, was slightly higher than during the preceding year, and a net profit of £194,625 was earned. Dividends totalling 3s. 6d. per £1 share were declared during this period. Arrangements have been made to reopen the Southern Section Colliery in order to meet the increased requirements of the enlarged Witbank Power Station. A further step taken to ensure the long term prospects of the company has been the decision to instal a washing plant at the Wolvekrans Colliery. It is proposed to finance these schemes out of accumulated funds, profits, and if necessary, by means of temporary loan facilities. In the meantime it will be necessary to restrict dividend distributions to the existing level.

INDUSTRIAL INTERESTS

The corporation is interested in the Cement Industry through the Pretoria Portland Cement Co. Ltd. and its associated com-

panies in South Africa; and in Southern Rhodesia through the Premier Portland Cement Co. (Rhodesia) Ltd.

Pretoria Portland Cement Co. Ltd.—For the year ended June 30, 1952, profits, after providing for taxation, amounted to £362,786 compared with £428,866 for the previous year. Dividends declared totalled 4s. 6d. per share compared with 5s. per share for the previous year. Due to the prevailing coal shortage production was seriously curtailed and this factor, combined with the inadequate supplies of trucks for despatches, was in the main responsible for the decrease in profits. Steps have since been taken by the Railway Administration to improve the transport position and the fourth kiln at the Slurry Works, which had been shut down since December 1950, was recommissioned in September 1952. It is expected that the new kiln at the Hercules Factory will be in production early in 1953.

The Hume Pipe Co. (South Africa) Ltd.—For the year ended June 30, 1952, profits, after providing for taxation, amounted to £265,497 compared with £200,727 for the previous year. Dividends totalling 8s. per share and a bonus of 1s. 6d. per share were declared during the financial year, which was at the same rate as for the preceding two years. The company's wholly owned subsidiary, Hume Steel South Africa (Proprietary) Ltd., had a successful year's trading despite the output restriction caused by the shortage of steel plate. The programme of reconstruction and enlargement of the Bellville and Koelenhof factories, begun in 1949, has now been practically completed and in the event of increased demand the company is in a position to derive the benefit of the greater productive capacity and efficiency resulting from this expansion programme.

OIL INTERESTS

Trinidad Leaseholds Ltd.—The consolidated net profit for the year ended June 30, 1952, after all charges, including provision for depreciation, taxation and contingencies, was £1,899,952 as against £1,470,705 in the previous year. Dividends were maintained at the rate of 10d. per 5s. stock unit free of tax. Refinery throughput increased by 16 per cent compared with the previous year. This was made possible by the completion of new tankage and improvements to the topping units. The progress of the Regent Oil Co. in the marketing of the company's products continued satisfactorily and since February 1, 1953, the Regent Co. markets its own grades of "Branded" petrol.



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Union Corporation Ltd.

FORMALLY speaking, Union Corporation Ltd., has only been in existence since 1918. Actually, however, it is one of the oldest mining-finance houses connected with the South African mining industry. For originally it carried out its functions under the name of A. Goertz & Co., which was founded in 1897.

In the same way as other leading Kaffir mining-finance houses, its present substantial position has been built up over a period of years largely on its dividend income and from profits on share dealings. Its valuable spread of assets include shares, debentures, and other securities in gold, diamonds, base metal and chrome mining, industrial ventures, and companies interested in property, commercial undertakings, exploration, and prospecting.

During its lifetime the Corporation has lost no opportunity to widen the scope of its interests. It has explored the indigenous wealth of Rhodesia and East Africa, ventured into Australia and Mexico, staked a claim in Yugoslavia, and in co-operation with other companies it participates in the diamond industry of Sierra Leone and the Gold Coast. By means of a successful combination of enterprise and hard work it has acquired a large portfolio of selected investments and a varied spread of assets, which now contribute substantially to its revenue.

Although the early mines of the Rand with which the Corporation was associated—May Consolidated, Princess Estate and Lancaster West—have long passed into the limbo, these have been replaced by some of the best gold producers in the Far Eastern Section which continue to be under its financial and technical control. These mines are East Geduld, Geduld Proprietary, Grootvlei Proprietary, Marievale Consolidated and Van Dyk Consolidated, and with the exception of the latter, perhaps, they are first-class mining investments, paying consistent dividends and having a long lease of life. In the field of mining exploration work, the most recent example of the Corporation's initiative was its formation of the St. Helena Gold Mines, the first producer in the Orange Free State goldfield. Other interests in the O.F.S. include mineral rights over certain farms, and investments in several undertakings now in the prospecting and development stage which will soon be contributing to its revenue. Two of these undertakings are Western Holdings, and the Stilfontein Gold Mining Co., the Far West Rand producer, whose progress to the production stage was remarkably rapid. Since pouring its first gold bar in July 1952, it has consistently increased its monthly profit and in March 1953 its working profit, excluding premium revenue, was over £78,000. Moreover, it is scheduled as a uranium producer and currently it is extending its leaching plant to treat uranium bearing slimes of four other mines in the Klerksdorp district.

The Corporation's interests outside South Africa are of a varied spread. It still retains a large holding in the San Francisco Mines of Mexico, and by virtue of its holding in Selection Trust, it is interested in the Northern Rhodesian copper-belt and in the West African diamond mining industry. Through its holding in Tsumeb Corporation lies its base metal interest in South-West Africa, in which Selection Trust is also interested. The San Francisco Mines of Mexico produce gold, silver, copper, lead and zinc.

In the industrial field the Corporation's holding in Bay Hall Trust has been successful and the dividend from this subsidiary was increased this year from 6½ per cent, free of tax, to 7 per cent, free of tax. The British Enka is another enterprise which has justified the Corporation's confidence, although it experienced a severe set-back in 1952 and the dividend was cut from 10 per cent to 6 per cent. The post-war growth of this rayon manufacturer has been striking; it has spent large amounts on the modernization and installation of entirely new spinning units and has enlarged its activities by acquiring the Breda-Visada. Good progress continues to be made by the South African Pulp and Paper, in which a shareholding is still retained. Expansion of the Enstra mill and the

construction of the new Tugela mill promise to lead to a big increase in the company's present output of paper which, it is hoped, will have a profitable reaction on revenue.

For the year ending December 31, 1952, the Union Corporation's earnings were £2,045,254 compared with £2,298,700. Taxation called for £818,300 as against £1,153,000, and the net amount available was £1,058,145 compared with £982,714. After placing £400,000 to exploration reserve, the dividend was 1s. 4d. per share or 53½ per cent, free of U.K. tax. This called for £620,000 and the amount carried forward was £351,686, compared with £313,541. The dividend, it must be explained, was on the shares of new denomination. It was in July of last year that the 12s. 6d. shares were split into Ordinary shares of 2s. 6d. each.

GEDULD PROPRIETARY MINES

Although it has been in existence well over half a century, Geduld Proprietary is still able to announce satisfactory profit figures. Although it is fully developed, ore is still being opened up in the mine, and areas which were once regarded as of little value, are being worked. Systematic testing of leaders below and above the Main Reef is continuing and ore is being reclaimed from all likely sources. Development work on the Black Reef is progressing, together with drilling to explore the Kimberley Reef horizon. What effect reclamation work will have on the mine's remaining life is yet to be seen, but ore reserves, although depleted, are still sufficient for two or three years.

In the waning stage of a mine's life there is, generally, a gradual deterioration of the ore reserves position but the process with Geduld, as with many other mines, has been accelerated by rising costs rendering low-grade ore unpayable.

Shortage of labour and of power supplies has hindered operations and the measure of relief granted to some of the newer mines by permitting Sunday working does not affect Geduld as milling has normally been on a seven-day-week basis. The management has dealt with the situation very satisfactorily by re-organizing mill maintenance work.

In addition to its mine, Geduld Proprietary has valuable assets in its holding of 3,308,425 stock units in East Geduld and 358,400 shares in Grootvlei Proprietary Mines. Dividend income from these investments has exceeded revenue from milling operations for some time.

EAST GEDULD MINES

The East Geduld Mines was formed to explore the south-eastward extension of the Geduld shoots, which have been such good ore carriers.

In order to minimize initial expenditure and expedite operations, the property was at first opened up by haulage ways and drives extended from the lowest workings of the parent undertaking. This proved to be very satisfactory and a vertical shaft was then sunk and brought into commission in 1931. Production started in the same year. Operations have steadily expanded and a second vertical shaft has been put down. Additionally, the company entered into an arrangement with Daggafontein, Grootvlei and Springs Mines for the sinking of a joint ventilation shaft near the common beacon of the four properties. The shaft programme has fulfilled all its expected promise.

It, too, has suffered from the effects of electric supply shortage notwithstanding the fact that it has endeavoured to make good the tube mill hours lost by operating the reduction plant on Sundays. The grade of ore sent to the mill has remained very consistent but tonnage has been on a lower scale and profits have tapered. The mine is one of the few whose ore reserves are below the grade of ore actually milled, which is due, for the most part, to the conservative method of computing the value of its reserves.

MILLING AND DEVELOPMENT RESULTS OF THE GROUP'S RAND MINES

Company	Year Ended Dec. 31	Milling Results			Results Per Ton			Development				Ore Reserves		
		Tons Milled (000)	Grade Milled (dwt.)	Oz. Yielded	Revenue s. d.	Cost s. d.	Profit s. d.	Footage Advanced	Footage Sampled	Per cent Payable	Average Value (in. dwt.)	Tons (000)	Value (dwt.)	Width (in.)
Geduld Prop. Mines	1951	1,259	2.93	184,426	38 4	27 10	10 6	17,485	12,955	14	215	3,500	3.4	51
	1952	1,253	2.90	181,922	37 3	29 9	7 6	17,542	11,390	22	217	3,100	3.4	52
East Geduld Mines	1951	1,738	6.00	521,489	78 5	25 5	53 0	11,132	7,195	48	188	12,400	5.7	51
	1952	1,725	6.00	517,544	76 9	27 2	49 7	11,526	7,535	50	185	12,000	5.7	51
Grootvlei Prop. Mines	1951	2,338	4.45	520,407	58 1	25 0	33 1	58,027	42,810	51	222	15,500	4.7	48
	1952	2,316	4.33	501,759	55 4	26 2	29 2	49,845	37,450	50	211	16,000	4.6	47
Van Dyk Consolidated Mines	1951	1,204	3.02	181,756	39 5	35 1	4 4	51,487	27,700	28	217	1,700	3.6	40
	1952	1,246	2.95	183,648	37 8	34 8	3 0	50,004	28,435	36	228	1,500	3.5	41
Marievale Consolidated Mines	1951	729	4.97	181,107	64 10	37 2	27 8	22,598	13,365	49	258	3,200	5.5	46
	1952	723	5.01	181,248	64 2	37 11	26 3	22,522	13,915	45	316	3,500	5.5	46

Both the Main and Kimberley Reefs are being worked, but so far the latter has opened up only a small tonnage of ore. The May Reef in the Kimberley Reef series has been explored.

The company still retains its holding of 537,600 stock units in the Grootvlei Proprietary Mines.

GROOTVLEI PROPRIETARY MINES

Further to the east of East Geduld on the Far Eastern Rand lies the property of the Grootvlei Proprietary Mines which has been greatly extended in claim area by the acquisition of ground at one time belonging to Palmietkuil Proprietary.

Although a large part of this additional mining area may not contain payable ore shoots, the acquisition has been greatly to the advantage of Grootvlei. Two fully equipped shafts on the property were taken over, and with two on the company's own mine and the joint ventilation shaft near the common boundary of East Geduld these have all been most useful in opening up the property.

Most of the ore has been obtained from the Main reef. The May reef horizon of the Kimberley reef was tested by a drilling programme extending over a long period but no payable values were revealed. Ore reserves continue to be built up and their estimated total tonnage is the highest of any mine on the Rand.

In order to meet the shortfall in electrical power supply, the mine has operated its reduction works on Sunday but has not been able to send the maximum tonnage to the mill. Costs have risen and profits have been on a lower scale. The grade of the ore has, however, remained steady at about 4.5 dwt. per ton.

Ventilation conditions in the north-eastern and central section of the mine have been greatly improved by ventilation fans installed at No. 5 shaft. Necessary work has also been undertaken at No. 6 shaft to provide separate upcast and downcast ventilation ways.

VAN DYK CONSOLIDATED MINES

Operations continue to be carried on profitably at Van Dyk, although the company has not yet re-entered the dividend list since it paid 2½ per cent in 1946.

So far as underground work is concerned, the main efforts are being directed to the southern part of the property. This is an extensive area; some of the claims adjoining it have been leased from the Government and some acquired from other companies. The southern section now totals some 4,000 claims out of the 5,790 claims which comprise the company's property.

It is in the southern section where the new No. 5 shaft has been sunk and its completion and equipment took place in 1950. Work has since been directed to driving, principally on the 48 level. Although a great deal has been done, no definite conclusions can, as yet, be drawn either from values exposed or from the pay ratio. For ventilation reasons, twin headings have been advanced, one on reef and the other in footwall. Folding and faulting of the rock formation have been encountered, which have resulted in a large amount of the footage developed being of an unpayable nature.

After driving some distance on the reef heading of 48 level west, the footwall was entered but the reef horizon was picked up later and disclosed satisfactory payability and value, both of which have shown a tendency to increase as driving has continued towards borehole No. V.S.6. The rate of development has increased as additional levels have become available.

MARIEVALE CONSOLIDATED MINES

The geographical position of the Marivale mine is situated on the eastern edge of the Far Eastern section, and works the rich shoots which run in a south-easterly direction through neighbouring properties. A faulted zone traverses the southern Draaikraal section and most work has been done on the central and western part of the property.

The Main reef is the principal ore carrier but the Kimberley reef is providing a satisfactory amount of ore. The area to the east of the main section—Bloemendal—has been tested by drilling but

the encouraging values, at one time found, did not persist. However, in the north-westerly part of the mine, where it veers towards the East Daggafontein, hopes of rich shoots are entertained.

Two shafts on the property, No. 1 verticle and No. 2 incline, serve the western and central parts while the north-central and eastern portions are serviced by the No. 5 vertical shaft which was put down later. It is connected with No. 1 shaft through which all ore is hoisted.

The plant of 60,000 tons monthly has been milling to capacity and the grade of ore has remained consistent. Ore reserves continue to be built up and have now reached a record figure.

ST. HELENA GOLD MINES

Improvement has continued on the property of St. Helena, both underground work and milling giving better results. The mine has, however, a long way to go before its capacity can be judged. It was the first of the Orange Free State undertakings to start up and, as the pioneer, has had to overcome many handicaps.

The company was incorporated early in 1946 and the incline shaft, equipped with a steam hoist, was started in the same year. The first underground development result on the Basal Reef was announced in January 1949, after difficulties not experienced by many other mines had been faced and overcome. The nearest railway siding was seven miles away; no electric power was available and water supplies were restricted to wells and boreholes. It was expedient at the time to sink the No. 3 shaft in the northern part of the property where the reefs were nearest to the surface, but the richer values, disclosed by boreholes, were a mile or so to the south-east where the No. 4 vertical shaft is positioned. A great deal of driving has consequently had to be done and much of the ore sent to the mill has been development rock.

The plant has a capacity of 50,000 tons and is to be increased to 80,000 tons, while any further extension will depend upon developments and other factors connected with the mine.

The first gold bar was poured in October 1951, and monthly outputs started with a first return for November of that year. They have gradually expanded with small but growing profits.

The annual report for 1952 recorded the figures of the first full year of gold production which resulted in 598,000 tons of ore being milled for a yield of 3.96 dwt. per ton. Revenue was 50s. 8d. per ton and working costs amounted to 46s. 6d. per ton, resulting in a profit of 4s. 2d. per ton milled and a total working profit of £123,287. After taking into account sundry items of income and expenditure, the net profit came out to £129,581. A debit balance and preliminary expenses had to be written off and provision made for specific items, and the unappropriated balance at the end of the year was £8,359. The total amount of gold won last year was 118,492 oz.; the price averaging 249s. per f.oz.

Total footage developed last year on the Basal and Leader Reefs was well in advance of that of 1951 and amounted to 65,604 ft. Of the 33,520 ft. sampled on Basal Reef, 43 per cent was payable averaging 311 in-dwt.

Ore reserves were recalculated at December 31 last and disclosed a total of 1,250,000 tons, of a value of 5.3 dwt. over a stoping width of 50 in. The tonnage was exactly double that at the end of the previous year.

Development in the mine last year was limited to the area above level 9 because no stopes can be developed below this horizon for some time to come due to the presence of a large strike fault in the No. 4 shaft area. Meanwhile preparations are being made to explore the reef below level 12 by a small incline shaft from that level. Water fissures in the mine have been stopped by cementation. Drilling operations have taken place and sufficient points of attack have been opened up to allow a large increase in development.

During the year the company increased its authorized capital from £4,000,000 to £5,000,000, and its issued capital from £3,750,000 to £4,812,500 by a rights issue to shareholders in the ratio of one new share for every four shares held at a price of 16s. per 10s. share.

FINANCIAL RESULTS OF THE GROUP'S RAND MINES

Company	Year Ended Dec. 31	Working Profit Excluding Gold Premium £	Premium Gold Sales £	Revenue from Shareholdings £	Sundry Revenue £	Sundry Expenses £	Taxation and Govt. Share of Profit £	Net Profit after Tax, etc. £	Capital Expenditure Reserve £	Dividend		Balance Unappropriated £	Issued Capital	
										Total £	Per Share s. d.		Total £	Share Unit s. d.
Geduld Prop. Mines	1951	543,855	114,541	772,833	23,518	20,201	277,070	1,154,476	64,281	1,077,382	14 9	387,440	1,460,857	20 0
	1952	410,368	58,365	726,005	25,914	36,664	126,253	1,054,735	123,617	913,036	12 6	376,948	1,460,857	20 0
East Geduld Mines	1951	4,281,444	322,669	82,557	16,100	22,102	2,522,275	2,158,393	144,126	1,950,000	4 4	537,797	1,800,000	4 0
	1952	4,111,891	162,462	71,068	21,568	14,038	2,313,720	2,029,231	140,381	1,837,500	4 1	573,494	1,800,000	4 0
Grootvlei Prop. Mines	1951	3,554,202	317,698	1,062	32,322	30,742	1,917,028	1,818,798	90,334	1,715,822	3 0	661,121	2,859,704	5 0
	1952	3,215,951	159,743	1,565	32,157	28,543	1,759,448	1,621,425	154,383	1,429,852	2 6	663,210	2,859,704	5 0
Van Dyk Consolidated Mines	1951	148,999	113,687	1,506	4,455	18,936	8	249,703	176,645	—	—	249,703	2,766,000	10 0
	1952	127,754	60,992	4,349	7,560	14,895	8	185,769	68,835	—	—	162,268	2,766,000	10 0
Marivale Consolidated Mines	1951	899,282	109,773	338	12,306	23,811	485,748	512,140	67,066	450,000	2 0	467,751	2,250,000	10 0
	1952	888,094	59,755	454	15,247	26,429	430,302	506,819	115,838	375,000	1 8	469,234	2,250,000	10 0

Johannesburg Consolidated Investment Co. Ltd.

ENTERPRISE combined with sound judgment are two of the many attributes which have enabled Johannesburg Consolidated to take its place as one of the outstanding Rand mining-finance houses. Its roots strike deep into the early history of the Rand and it has created some of that field's most famous mines, while at the same time it has invested its capital in diamonds, platinum, coal, copper and other base metals, together with industrial enterprises—all of which have proved profitable.

On a parallel with the enterprise "Johnnies" displayed on the Rand was its early entry into the Orange Free State goldfields. This resulted in the formation of the Free State Development and Investment Corporation from which was formed two prominent gold mining companies—Freddies North and Freddies South, both of which will be gold producers this year.

This entry into the O.F.S. goldfield will help to make up for the waning production and lowered return from the group's older producers most of which, with the exception of Randfontein, give little evidence of a long life ahead. Yet they are, for the most part, still consistent gold producers and would respond to any definite downward trend in working costs or a more realistic value for gold.

The company has always believed in the potentialities of platinum and after many years of untiring effort, can now claim to have a very substantial stake in the industry in South Africa largely through the associated Rustenburg Platinum Mines. This company took over the Union Platinum Mining and has embarked upon a major scheme of expansion to increase output both at its Rustenburg and Union sections. It is hoped to bring the combined milling capacity of these two mines up to 125,000 tons per month.

Other major activities include the coal mining companies of the group which is now selling around 1,800,000 tons of coal a year. It is through its substantial holding in De Beers Consolidated that "Johnnies" has a large stake in diamonds, while it is also identified with the future of uranium by its control of Randfontein Estates and East Champ d'Or. Copper interests are centred in the companies on the Rhodesian Copperbelt.

In addition to the foregoing, the company has a number of different interests in the United Kingdom, including control of the Abbeystown Mining Co. Ltd. in County Sligo, Eire, through the medium of a wholly-owned subsidiary, Llanrwst Lead Mines Ltd. in North Wales.

The year to June 30, 1952, was not a very propitious one for mining-finance and consequently the company's income showed a decline, although the report showed an eminently satisfactory position. Profits, before taxation, amounted to £1,444,237, being some £184,410 lower than in the preceding year. Taxation was slightly less amounting to £605,539 against £745,110. There was no allocation to general reserve, compared with £500,000 in the previous year, but the distribution to shareholders was maintained for the seventh year in succession at 17½ per cent, absorbing £362,906 after deduction of U.K. income tax.

A sound position was disclosed by the balance sheet. Investments showed a reduction of £1,369,166 over the previous year at £10,500,852, having a market value substantially in excess of the book value. The company's liquid position is strong. Current assets figured at £2,671,952 against current liabilities of £1,452,050. Revenue reserves and surplus totalled £7,790,344. "Johnnies" were unsuccessful in a profits tax appeal before the House of Lords, where in March 1953 the appeal was dismissed with costs.

An application was made by the company to H.M. Treasury in the latter part of 1951 for permission to transfer the central management and control of the company from the United Kingdom to South Africa. In mid-1952 H.M. Treasury intimated its refusal to consent to the transfer.

EAST CHAMP D'OR GOLD MINING

Although this mine is the smallest of the "Johnnies" group and one of the smallest on the Central Rand, both tonnage and profits continue to be consistently good while its record of dividend payments has not been checked except for the necessity of paying rather smaller amounts.

The two reefs exploited have been the Main and the South. Some attention has been given to the Bird reef which at one time yielded satisfactory values on sampling, but there was not sufficient encouragement to evoke the belief that exploratory work on the horizon would yield significant tonnages of ore.

The area of the mine remaining to be developed is now relatively unimportant and comprises heavily faulted blocks adjacent to the Witpoortje Fault. Development footage advanced has continued to show a decline. Reserve tonnage has dwindled and increasing costs has rendered ore unpayable which would otherwise be available for milling.

Operations during 1952 were again on a lower scale and the working profit, including £17,517 received from gold premium, was reduced to £97,334, compared with £128,407 in 1951.

On April 29, 1953, the company formally announced that it had been accepted as an uranium producer. Investigations indicated that the estimated tonnage of uranium-bearing ore was sufficiently great to justify exploitation but was not sufficient to justify the erection of a treatment plant by the company. For this purpose Randfontein Estates will extend its plant for the treatment of the company's uranium-bearing slimes.

GOVERNMENT GOLD MINING AREAS

After about forty years' productivity, the working profits of this Far Eastern Rand mine are now on a much smaller scale. Nevertheless, they continue to be consistently good and the monthly throughput is satisfactory.

With the exhaustion of the Main Reef Leader, the mine has been dependent on low-grade ore from the Upper or Hanging Wall Leaders, Black reef, reclamation ore and the Kimberley reef. Work on this latter reef is being carried out in those portions of the mine that have given the most favourable indications. On the Kimberley reef horizon, 129,125 ft. of primary development has been accomplished since the inception of the programme. Of the tonnage milled last year, 72.87 per cent was derived from the Black reef section.

A decreased amount of development was carried out on the mine last year but the pay ratio and value of the 31,535 ft. sampled were rather better and encouraging results were also derived from the work done on the Kimberley reef series, 57.79 per cent of the 5,485 ft. sampled proving payable, averaging 5.7 dwt. per ton.

Ore reserves, like those of so many mines, are now lower. At the end of 1952 they amounted to 7,528,000 tons of 2.9 dwt. and included in the computation were 759,000 tons on the Kimberley reef horizon.

The mill dealt with a larger tonnage last year—2,943,000 tons, recovery being 2.6 dwt., and as a result there was an increase of 9,988 oz. gold produced. Working costs dropped 9d. per ton to 29s. 2d. Profit from gold mining amounted to £607,626 compared with £639,414, revenue received from premium gold sales was also lower at £120,581 compared with £229,831, so that total profits were reduced. Dividend payments aggregated 2s. compared with 2s. 1½d. in the preceding year.

NEW STATE AREAS

Although this company has given statutory notice of its intention to discontinue operations, which should have taken effect as from June of last year, it has managed to continue both mining and milling. Mining operations in recent months have resulted in small monthly losses but these have been offset by the profits from sales of gold at a premium. After thirty years' continuous milling, however, the end of the mine's life is recognized to be in sight.

No development of any consequence remains to be done in the mine and work is directed solely to reclamation. Ore reserves are sufficient to keep the mill supplied for several months and the treatment of old residues, from which a certain revenue is derived, will continue while it is profitable to do so.

Tonnage of ore milled during 1952 amounted to 543,000 tons, while in addition, 681,000 tons of old residues were treated giving a total gold recovery of 75,127 oz. Yield from the ore was 2.320 dwt. per ton. Working profit, with revenue received from various sources less sundry items of expenditure, amounted to £37,923 as compared with £88,663. Additional revenue received from premium gold sales was £23,563. Costs averaged 34s. 6d. per ton milled compared with 32s. 7d. for 1951.

RANDFONTEIN ESTATES

The Randfontein is particularly identified with the future of uranium in South Africa by reason of the fact that, as one of the largest gold producers on the Rand, it has now been officially scheduled as a potential producer of the metal. The conglomerates in the Bird reef series which underly the property are to be treated and the plant now being erected is timed to come into operation next year. The company is also extending its plant to treat the uranium-bearing slimes from East Champ d'Or and this extension will also be completed, it is anticipated, during the first half of 1954. The cost of the plant and the extension are being financed by a loan from the Atomic Energy Board.

In addition to these arrangements further negotiations have been concluded whereby the company will erect a plant on its property to produce sulphuric acid for use in connection with the production of uranium. The erection of both plants commenced late in 1952.

Following on the decision to list the company as a uranium producer it was decided that a certain proportion of the tonnage

mined and treated from other reefs on the property would be substituted by an equivalent tonnage to be mined from the Bird reef.

Development footage advanced last year, excluding that on the Bird reef, was 81,629 ft. Of the 37,170 ft. sampled, 37.80 per cent was payable averaging 7.2 dwt. In addition 34,341 ft. was accomplished on the Bird reef horizon. Ore reserves at the end of 1952 amounted to 3,580,000 tons with an average value of 3.0 dwt.

An increased amount of ore was dealt with by the mill last year—4,127,000 as against 4,097,000 tons. The yield was 2,398 dwt. giving a total gold recovery of 494,889 oz. Costs were 7d. per ton higher at 28s. 6d. The profit from gold mining, excluding sums totalling £154,225 received in respect of gold sold at higher than standard prices, was £319,283. This compared with £463,180 the previous year and necessitated the dividend being decreased to 1s. 9d. as against 2s. 3d. previously.

In the exploratory work on farms outside the company's mining area, drilling has proceeded on Gemspost, Gemsbokfontein and Panvlatte and, last year, a total footage of 10,969 ft. was drilled.

WITWATERSRAND GOLD MINING

This company has been conducting its mining operations at a loss since the end of 1952. Recent distributions have been made to shareholders by way of a return of capital.

The mine has given a good account of itself during its sixty years, and operations underground, which for some time have been directed to reclamation work, have yielded small quantities of ore. The extraction of the south vertical shaft pillar has been proceeding together with work necessary in connection with the re-conditioning of the south incline shaft. This has enabled ore to be brought up from a section of the mine which became inaccessible as a result of rock bursts.

A small amount of development was done last year—4,703 ft., of which 3,840 ft. were sampled, giving a pay ratio of 19.5 per cent, and averaging 6.2 dwt. Ore reserves are estimated at 109,000 tons of 2.7 dwt.

The mill was able to deal with 717,000 tons of ore last year of 2.38 dwt. and gold recovered amounted to 85,349 oz. costs rose 1s. per ton to 29s. 5d. and the profit from gold mining was £10,794 as compared with £16,187. Additionally, an amount of £25,893 was received in respect of increased revenue from sales of gold at higher than standard prices.

With the third return of capital to shareholders, the £1 shares were reduced to a denomination of 16s. and the end of the mine's life as an active producer was in sight. Indeed, on April 28, 1953, the company announced it had given the customary statutory notice of its intention to discontinue mining operations. This step was hastened by the fact that working costs have risen since the end of 1952 to 31s. 4d. per ton milled in March last.

O.F.S. VENTURES AND INTERESTS

One of the most prominent ventures connected with the Orange Free State has been the Free State Development & Investment Corporation.

It was formed in 1944 to acquire the properties of Johannesburg Consolidated Investment and its associates in the new field. Option and participation rights were originally held over 360,900 morgen in various areas on which survey and exploratory work was carried out. Uneconomical ground was abandoned and the chief asset to emerge from this big aggregation of land was found to be around the township of Odendaalsrus. This area consisted of mineral rights over 12,600 morgen surrounding and to the north of the township, which was subject to an intensive drilling campaign. A grid system of boreholes was put down and the success of the programme resulted in the segregation of the area and the formation of Freddie's North Lease Area and Freddie's South Lease Area. The large shareholding held in these two companies forms the Free State Development Corporation's major interest. The two "Freddie's" have shaped well and give promise of becoming two of the most important gold-winners in the O.F.S. They have both been thoroughly surveyed, drilled and prospected and are now being developed on a scale compatible with their size.

During the last financial year ended March 31, 1952, Free State Development & Investment Corporation exercised options to purchase mineral rights over 414 morgen in the Ventersburg district, bringing the total area over which the company had acquired rights to approximately 18,535 morgen, which included areas totalling 7,654 morgen ceded to other companies. Expenditure in connection with the mineral and surface rights held, after deducting recoupments in respect of the cost of the areas—the subject of mining leases ceded to other companies—was £246,664.

The company has a "Corridor Agreement" with Odendaalsrus Gold, General Investments and Extensions ("Oggies") and an arrangement with Freddie's North and Freddie's South in connection with land for township purposes. This entitled the company to receive cash and share consideration from "Oggies," some of which has already been received on account.

In addition to its large share and Loan Stock holdings in the two

"Freddie's" subsidiaries at March 31, 1952, the company held 51,785 shares in Harmony Gold Mining, 38,605 shares in Merriespruit O.F.S. Gold Mining, and 236,024 shares in Virginia O.F.S. Gold Mining.

The book value of these investments at March 31, 1952, the date of the last published accounts, was £1,125,678, but since then the gold share market has been more active and the quoted value of these shareholdings has risen substantially and is now well above the balance sheet figure. The authorized capital is £1,000,000.

FREDDIE'S NORTH LEASE AREA

Operations on this property have gone ahead with very encouraging results. Simultaneously with the sinking of the shafts, both of which have reached their final depth, surface work has been proceeded with and the company was able to report the completion of the reduction plant towards the end of last year. The necessary running-in operations were carried out and revenue derived from initial milling was small but valuable experience gained. Full capacity of 50,000 tons monthly has not yet been attained but sufficient ore has been obtained from stoping and development sources to enable good tests to be made and the throughput will be increased as rapidly as ore becomes available.

Underground work in the mine has been going ahead and development has been undertaken from both shafts. Hoisting and other facilities have made good progress and lateral development has gone forward as rapidly as possible in order to reach the position from which raising can be carried out with the minimum delay. Initial drives, unavoidably, have been in country rock and reef exposures have been limited but quite satisfactory.

Work has been concentrated on the tunnel connecting the two shafts and it is hoped that an early connection will be made.

Commendable progress was made last year in all directions. Apart from the completion of the reduction plant, a second air compressor was installed, workshops built and houses completed. Skips, cages and shaft columns were completed at both shafts and underground stations and excavations made.

The development footage accomplished amounted to 19,045 ft. Of the 1,230 ft. sampled, 98.37 per cent proved payable and averaged 16.6 dwt. Since the conclusion of the financial year the development programme has been continued. It is probable that the Basal reef over the area of the mine so far explored will be overlain by measures referred to locally as the "khaki shale" which will call for special measures and a rescue method of stoping will be undertaken. This may tend to increase mining costs but this may be more than offset by the greater proportion of gold that can, as a result, be extracted from the ore actually crushed.

FREDDIE'S SOUTH LEASE AREA

As with its sister undertaking both underground and surface work is well in hand.

General construction of the reduction plant, with a capacity of 50,000 tons a month, made good progress last year and the company was able to report its completion in the latter quarter of 1952. This was considered a very satisfactory performance having regard to the delays experienced in delivery of equipment. Teething troubles in connection with the plant's starting up were overcome and the revenue derived from initial milling was small but valuable experience was gained.

Work in the mine has proceeded as rapidly as facilities have allowed and lateral development has been carried out in order to reach the position from which raising could be undertaken. Initial drives were in country rock and reef exposures were limited, but subsequent driving has encountered good values. The linking up of the two shafts has been the chief task and a connection is expected to be made shortly.

Development footage advanced has disclosed that it is probable that the Basal reef will, over the area so far explored, be overlain in Freddie's North, by measures referred to locally as the "khaki shale." This varies in thickness from a few inches up to 10 ft. Where it is not possible to support this overlying strata and where the thickness of the shales is such that special measures for the control of stoping widths are necessary, it is intended to carry out a rescue method of stoping. It is not anticipated that any material difficulties will arise.

The development footage accomplished last year amounted to 18,041 ft.; 1,625 ft. were sampled, of which 99.39 per cent proved payable, averaging 14.2 dwt. over 31 in., equivalent to 440 in.-dwt.

Both the shafts on the property were sunk to their final depths last year: No. 1 to 5,186 ft. and No. 2 to 5,778 ft. Permanent skips, cages and shaft columns were completed and all the permanent winders were commissioned.

The mine store, explosive magazines, timber treatment plant and the surface construction programme generally was completed except for minor items.

Since the conclusion of the financial year, the development programme has been continued with very satisfactory results.

General Mining & Finance Corporation Ltd.

THIS mining and finance house has an impressive dividend record, for despite the political and economic upheavals of the last 17 years, it has maintained its dividends during that period at 25 per cent.

That the Corporation has been able to achieve this performance consistently throughout the years arises, in large measure, from the quality of the investments in its portfolio which include Consolidated Rand Investment and Trust Co., Crown Mines, Durban Roodepoort Deep, East Rand Proprietary, General Exploration O.F.S., Van Ryn Gold Mines, West Rand Consolidated, in which it holds a majority interest, and West Witwatersrand Areas. It also manages South Roodepoort Main Reef.

Of these companies, West Rand Consolidated which is, in any event, one of the leading Rand gold producers, has carved out a special niche for itself in the annals of the South African mining industry by becoming the first established producer of uranium. Another company holding a valued place in the Corporation's portfolio is General Exploration Orange Free State (Geoffries) which, as its name implies, is interested in prospecting in the O.F.S. In any subsidiary floated by "Geoffries" the Corporation has the right to subscribe at par for 30 per cent of the initial working capital.

During the year to December 31, 1952, profits amounted to £611,402. Some £115,332 was appropriated to write investments down to their market value—a further £125,000 was also taken out of the investment reserve for this purpose—and £430,415 was used to pay the 6 per cent dividend on the Preference shares and the 25 per cent dividend on the Ordinary shares, leaving a margin of £65,655.

WEST RAND CONSOLIDATED MINES

West Rand Consolidated will occupy a distinguished place in the history of South African mining, for it is the first of the gold mining companies to become an established uranium producer. And despite the delays which often afflict mining companies when undertaking expansion programmes, the uranium plant started up, as forecast, in the second half of 1952. Actually, operations commenced in September, 1952, and the official opening of the plant was performed by the South African Prime Minister, Dr. D. F. Malan, on October 8.

During the last quarter of 1952, the company made an estimated net profit of £124,707, but because of difficulties in calculating the amount to be received for the uranium, certain adjustments will have to be made. There has been a good deal of speculation as to whether the plant has been running at full capacity, and if, as seems likely, it has not, what proportion of capacity the December quarter's results represent.

In 1952, £971,669 was spent on the uranium plant making a total to the end of 1952, of £1,520,944, to which must be added £43,320 interest on the loans of £1,524,000 already received by the company through the Atomic Energy Board. Of these loans £3,056 remains to be spent and this is earmarked for additional storage and housing for employees. No provision has been made in the 1952 accounts for the redemption of the capital cost of the uranium plant, which, together with the relevant interest, is to be repaid over ten years from the date of full production of the plant. As no date has yet been determined, the inference has been drawn that the plant was not running fully at the date of the report, March 30, 1953.

In accordance with the decision announced earlier, the Government is to participate in uranium profits on the same basis as the gold formula. After allowing for tax, it had been estimated that uranium earnings would be equal to 9d. to 1s. per ordinary share, but since the estimate was published, new arrangements have been made, making for a higher and presumably more profitable price for uranium.

In redemption of an earlier promise, the company is examining the possibility of expanding the production of uranium now that operations have started, but no decisions have yet been taken.

Results for the past two years have been:

	1951	1952
Tons milled.....	2,537,000	2,624,000
Total yield (oz.)	403,892	399,838
Yield per ton (dwt.)	3,184	3,048
Revenue per ton (sh.).....	41.47	38.89
Costs per ton (sh.)	25.87	27.58
Profit per ton (sh.)	15.60	11.31
Development footage.....	77,044	87,794

Ore reserves at December 31, 1952, totalled 8,240,000 tons, averaging 3.4 dwt. over 47 in., excluding 630,000 tons in shaft pillars averaging 4.8 dwt. over 43 in.

The total working profit for 1952 was £1,757,161 against £2,137,143. Taxation took £351,190 as compared with £800,504, the reduction presumably being the result of the recent heavy capital expenditure. The amount so spent in 1952 was £490,399. Dividends were maintained at 3s. per Ordinary share, and at £8 10s. per Deferred share. At the end of 1952, the company held £949,891 in cash, but this will be reduced by £425,000 when the final dividend is distributed.

SOUTH ROODEPORT MAIN REEF

By the usual Rand standards, South Roodepoort's 2,084 claims are a comparatively small area, but it will be enlarged if the formal application for a mining lease is granted. This application relates to certain mineralized areas of farms Rietvalei No. 9 and Lui-paardsvlei No. 30; part of these farms are included in the mining lease already held.

Some 6,308 ft. of development has been carried out on the Rietvalei farm with 54.8 per cent payability over 3,430 ft. sampled, the average grade being 10.3 dwt. per ton over a channel width of 27 in., or 278 in.-dwt. An additional 4,767 ft. of development has been advanced on farm Lui-paardsvlei No. 30 in the claims held under an agreement with the Johannesburg Consolidated Investment Co., of which 1,198 ft. were on reef with 22.5 per cent payability over 1,155 ft. sampled, averaging 11.7 dwt. per ton over a channel width of 23 in. or 270 in.-dwt.

The working profit in 1951-52 was £295,757, against £303,345. Dividends were maintained at 15 per cent, and taxation took £150,874. After appropriating £43,399 capital expenditure, the carry forward rose by £335 to £109,419.

	1950/51	1951/52
Tons milled.....	321,000	325,000
Total yield (oz.)	71,898	72,572
Yield per ton (dwt.)	4.48	4.47
Revenue per ton (sh.).....	58.1	57.7
Costs per ton (sh.)	39.2	39.5
Profit per ton (sh.)	18.9	18.2
Development footage.....	22,148	28,769

GENERAL EXPLORATION ORANGE FREE STATE

The name "Geoffries" is to the forefront among the undertakings associated with the exploration and opening up of Orange Free State.

After being in existence nearly seven years the General Exploration Orange Free State Ltd.—to give the company its full title—can be said to have fulfilled the objects for which it was formed. It was established under the aegis of the General Mining Corporation to explore and test the mineral potentialities of various areas held under option contracts with a view to turning these and sundry participation rights to account. The company owns shares and Convertible Loan Stock in Freddie's North Lease Area and Freddie's South Lease Area. It has also become interested, through the exercise of subscription rights, in Virginia O.F.S. and Merriespruit, whose properties are situated in the Sand River area of the Free State. These participations give "Geoffries" a representative holding in four leading potential gold producers. Development on the two first-named companies has been rather better than had been expected from the borehole results and Virginia has been officially named as a producer of uranium in 1955. The outlook for these companies is, therefore, promising and "Geoffries" will benefit when they reach the production stage.

At the start of the company's career very large prospecting areas were held. Unpromising areas have since been abandoned and other farms acquired, with the result that the company has now an exceedingly interesting selection of ground on which drilling has been carried out.

The main properties are centred to the north-west of the town of Odendaalsrus and include the farms Spes Bona, Rosedale, Welt-evreden and Welgevonden. It holds mineral rights in the Hoopstead, Kroonstad, Ventersburg and Winburg districts, together with participating rights over all but the last district mentioned. Additionally it has participating rights with other companies over farms which are the centre of attention.

Altogether, "Geoffries" has mineral rights in the O.F.S. over a total area of 5,164 morgen and the area held under freehold title measures 2,650 morgen, while participating rights are held over 2,900 morgen. This is a very large spread in a new mining field of which potentialities are undoubtedly very great.

For many years the company has been engaged in a programme of drilling both on its own account and conjointly with other companies. It entered into an arrangement with the Anglo Transvaal Consolidated and the Middle Witwatersrand Western Areas for the pooling of contiguous ground. The area affected in this co-operative arrangement covers the farms Van den Heeverstrust, Kleinbegin, Britzpan and Stephanus Rust, all held by Middle Wits, and Spes Bona, Rosedale, Weltevreden and Welgevonden which, as previously mentioned belong to "Geoffries."

PROSPECT OF TWO NEW MINES

Drilling has taken place on large areas comprising these farms, with very successful and interesting results. Ground so far tested may form the nucleus of two mining companies. In the event of it being decided to make an application to the Mining Leases Board for a mining lease, a first company under control of Anglo Transvaal will take in certain areas of the above-mentioned tested ground while the remainder will form the basic area for a second company to be under the administration of General Mining.

Subject to existing rights, "Geoffries" and other participants will become entitled to vendor and subscription rights in the first company *pro rata* to the estimated payable tonnage contributed by each company. Vendor and subscription rights in the company to come under the aegis of General Mining will also be allotted *pro rata* to the estimated payable tonnage contributed by the participants. Normally the participation for joint ground is based on surface area, but this somewhat novel method is the consequence of the thick reefs of the type indicated on the "Rainbow" formation of this region causing the value of the surface ground to vary to a far greater degree than with the more normal Basal and Leader reefs. The task of calculating the possible worth of the potential mine and precise participations, cannot be settled until actual mining begins.

The conception of these potential new companies has come about from the conjoint programme of drilling which has been in operation for the past three or four years and has disclosed the intersection of an intriguing series of "Rainbow" reefs.

SIGNIFICANCE OF THE VDH1 BOREHOLE

The drilling of borehole VDH1 on farm Van den Heeverstrust created a good deal of interest as it intersected a series of gold bearing bands, which could not be correlated with the Basal or Leader reefs and indeed, these reefs were later cut in the same borehole. The series was encountered between 4,690 ft. and 5,304 ft. and gave values up to 1,652 in.-dwt. Later a borehole K1 was sunk on farm Kromdraai about 14,000 ft. north-west of VDH1 and the gold bearing series was again found but with less spectacular results. Nevertheless, the highest band assayed 554 in.-dwt. and the Leader-Basal system was again cut lower down. This raised the question as to whether there was any connection between these results. Borehole TV2 was put down on farm Te Vrede, about halfway between VDH1 and K1 and once more the series, now known as the "Rainbow" reef, was intersected but the values were better than anything previously discovered in this drilling programme, values of 5,306 in.-dwt. and 4,052 in.-dwt. being exposed between 4,776 ft. and 5,652 ft.

The two problems which now faced the engineers were how far south did this "Rainbow" line extend and how wide was it. A hole, RD1, was sunk about 7,000 ft. south-east of VDH1 on farm Rosedale 1 in an attempt to answer the first question. Three gold series in the upper band were discovered, the highest values being 1,439 in.-dwt. Another borehole, ERK1 was sunk about 3,000 ft. away from RD1 on the line running through the previous holes. Two series in the upper reefs were intersected, the highest value

being 1,005 in.-dwt. The line appears to run across the "Geoffries" property from K1 to ERK1, a distance of 24,000 ft.

The rest of the extensive drilling programme was concerned with trying to ascertain how far east and west of the line the "Rainbow" and other reefs extend. To the west of the line, two boreholes have given very satisfactory results. Roughly half-way between VDH1 and TV2, and roughly 500 ft. from the line, borehole TV3 intersected the "Rainbow" reef with a top value of 4,118 in.-dwt. and with six values, any one of which would be considered payable. Approximately half-way between VDH1 and RD1 and again about 500 ft. from the line, borehole RD2 cut the multiple reefs with values up to 830 in.-dwt. On the eastern side of the line, VDH5, about 500 ft. north-east of VDH1, was successful in finding multiple reefs, but the values were not very high, although lower down values of 535 in.-dwt. were found on the A reef and 3,130 in.-dwt. in the Basal reef. The remaining holes on this side of the line have either failed to find the upper multiple reefs or the values were negligible, but that term cannot be applied to the values found in these holes for the other reefs. A deflection in borehole Spes Bona 1, for example, gave 259 in.-dwt. in the Basal reef and in VDH3, the Basal reef returned 237 in.-dwt.

The sample of borehole results from the "Geoffries" property indicated that the area has a high potential value so far as gold is concerned. The property also has possibilities as a coal producer.

COAL IN THE O.F.S.

Considerable portions of the farms Spes Bona, Welgevonden and Weltevreden have been proved to be underlain by coal horizons. Although the existence of coal in the Free State has been known for many years, "Geoffries" is the most prominent of all the companies working in the field to have intersected seams. The various holes which have been sunk in this area have given a calorific value of interest but sufficient work has not yet been done to determine the extent of the coal area. Analysis of the coal samples—depth and thickness of the seams—have put the occurrences on Weltevreden within economic limits.

The generation of electric power would, no doubt, be the ultimate goal if sufficient coal is found of a commercial value. It has in the past been said that the Free State coal is of low grade but that if it were fed into spray furnaces it could be converted economically into electricity. This would be a project for the future; meantime, the field is relying on Escom for its electric supply but this national undertaking is handicapped by the limiting of generating stations. Escom is providing for eight new major power stations in the next six years and the extension of several existing ones. Three of the new stations will augment the Rand supplies; Vierfontein just to the south of the Vaal River (300,000 kW.), Taaibos (420,000 kW.) and Wilge (180,000 kW.). When these stations are completed, the mining companies—especially "Geoffries" will have to decide whether the coal wealth in this area is sufficient to justify the establishment of coal mines and gold mines on adjacent ground as has been done in certain areas of the eastern Rand.

The abandonment of large areas over which the company had options will enable it to concentrate its energies and finance on the by no means small area to the north-west of Odendaalsrus. The drilling already completed has cost a great deal of money. The balance sheet at December 31, 1952, shows that after writing off various sums in respect of areas abandoned, the cost of drilling and prospecting was £184,343. It also shows that the company continues to have at its disposal ample liquid resources for the immediate future, cash being £316,326. The investments mentioned earlier, and which are not to be considered as liquid assets, are carried at a value of £370,648. The issued capital has remained unchanged at £668,125.

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- The nature of gold shares and the factors affecting their value

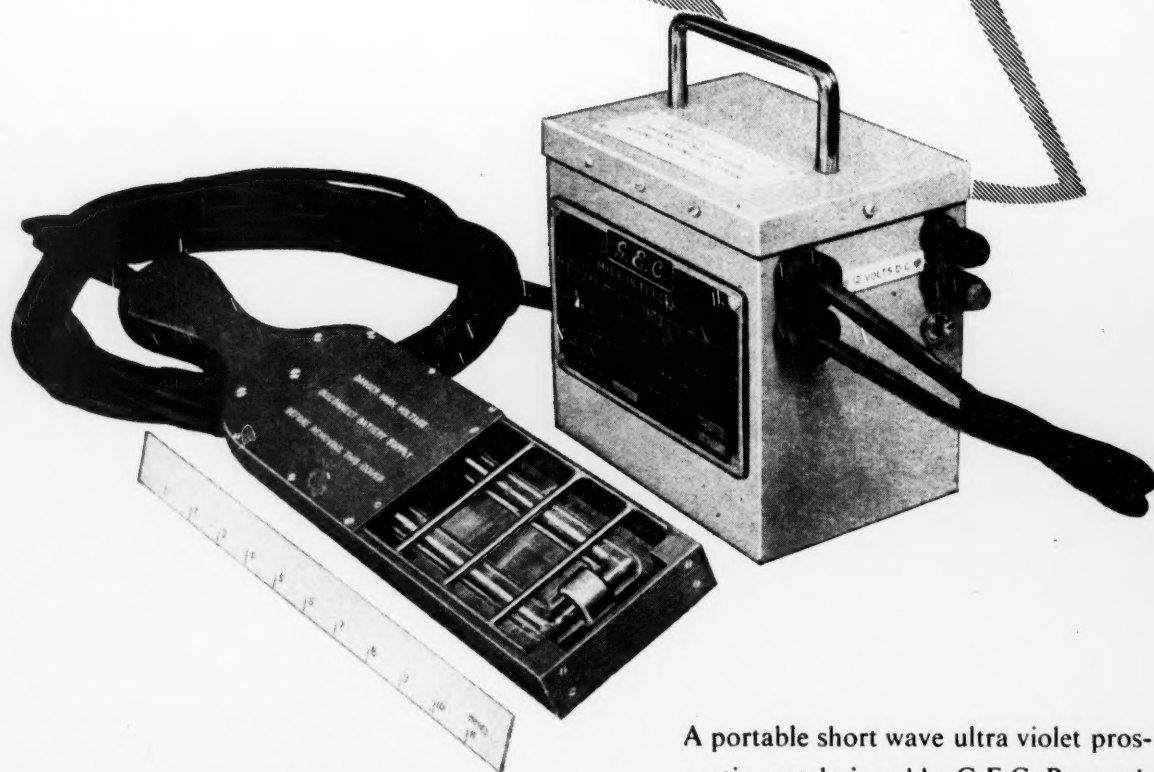
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New Union Goldfields Ltd.

THE year ended June 30, 1952, covered the first full year's operations since the lifting of the Judicial Management Order against the company in June, 1951. The policy followed during this period was largely one of consolidation, advantage being taken of the decline in Stock Exchange prices to strengthen the company's share control over various of its associated enterprises. Expenditure during the period on the purchase of shares in associated and subsidiary companies amounted to some £578,000.

ASSOCIATED COMPANIES

The company acts in an administrative capacity as Managers, Secretaries, Transfer Secretaries, and, where appropriate, Consulting Engineers to a number of companies included amongst which are:—

Lydenburg Gold Farms Co. Ltd.
Middlelei Estate & Gold Mining Co. Ltd.
New Durban Gold and Industrials Ltd.
New Free State Gold Estates Ltd.
New Nigel Estate & Gold Mining Co. Ltd.
New Transvaal Gold Farms Ltd.
New Union General Industries Ltd.
New Vaal Farms Ltd.
New Witwatersrand Gold Exploration Co. Ltd.
Radford Adlington Holdings (South Africa) Ltd.
Reef Nigel Exploration Gold Mining Co. Ltd.
Selected Mining Holdings Ltd.
Star Diamonds (Proprietary) Ltd.
West Rand Development & Exploration Ltd.
Westar Diamond Mining Co. Ltd.
Witwatersrand Deep Ltd.
Wit. Extensions Ltd.

NEW UNION'S SHAREHOLDINGS

Apart from its interests in the abovementioned enterprises which it administers, the company has substantial shareholdings, held either directly or through affiliated financial companies, in a number of developing and producing gold mining companies,

exploratory and financial companies, and industrial concerns, including:—

Blyvooruitzicht Gold Mining Co. Ltd.
Eastern Transvaal Consolidated Mines Ltd.
Freddies North Lease Area Ltd.
Freddies South Lease Area Ltd.
Free State Development & Investment Corporation Ltd.
General Exploration Orange Free State Ltd.
Harmony Gold Mining Co. Ltd.
H.E. Proprietary Ltd.
Loraine Gold Mines Ltd.
New Mines Ltd.
Paarl Wine and Brandy Co. Ltd.
Rooderand Main Reef Mines Ltd.
S.A. Grain & Seeds Distributors Ltd.
The S.A. Alkali Ltd.
Union Free State Coal & Gold Mines Ltd.
Village Main Reef Gold Mining Co. (1934) Ltd.
West Driefontein Gold Mining Co. Ltd.

At June 30, 1952, the company's current assets amounted to £282,881 and exceeded current liabilities by some £196,500 of which excess £153,400 was represented by cash at bank and on short call.

Since the lifting of the Judicial Management Order the board has settled certain of the larger contested claims against the company, and the removal of the encumbrance of these contingent liabilities over part of the company's assets has facilitated planning for the future and removed a handicap which had been burdensome to the company for a long time past.

The net profit for the period June 8, 1951, to June 30, 1952, was £57,200 compared with £44,000 for the preceding period July 1, 1950, to June 7, 1951, and during the same financial period reserves and provisions were strengthened by appropriating a net sum of £431,366 out of past accumulated profits and from share premiums received. At June 30, 1952, free revenue reserves totalled £260,000, the contingencies reserve stood at £290,000, and provisions against diminution in value of particular assets amounted to £1,000,000, the last-named figure including £900,000 in respect of shareholdings.



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Henderson's Transvaal Estates Ltd.

THE long and successful trading career enjoyed by Henderson's Transvaal Estates Ltd. since its formation in 1912 has been largely due to the company's ability to widen its scope and enlarge its interests in keeping with the mining and industrial expansion of South Africa. Its valuable spread of assets now bring in substantial revenue from such varied sources as rents, royalties and licences, sales of properties, dividends from investments, stocks and share transactions, colliery interests, industrial ventures, etc. Most of its revenue is derived from subsidiary undertakings, namely: The Henderson Consolidated Corporation Ltd., Mineral Holdings Ltd., Tweefontein Colliery Ltd., and Tweefontein United Collieries Ltd. The parent Company has, in addition, participation and share interests in many other undertakings occupied in financial, industrial and other channels.

TRADING RESULTS

The consolidated profit and loss account for the year ended March 31, 1952, showed that profit from coal mining brought in £131,380 of the total revenue of £219,998—the balance being largely income from investments. After providing for London and South African administration expenses, providing £20,000 for depreciation of coal mining assets, and paying taxation amounting to £96,588, the available net balance was £56,007. Of this net amount £45,013 accrued to the parent company, which is equivalent to gross earnings of 15.2 per cent on its issued capital, and £10,994 belonged to minority interests. There was no allocation to reserve which remained at £350,000 and by virtue of the company's strong financial position it was able to maintain the dividend of 15 per cent for the sixth year in succession.

The distribution required £44,373 and the group carry forward at the financial year-end was £173,830.

The balance sheet at March 31, 1952, disclosed a satisfactory financial position. Fixed assets, at cost, stood in the balance sheet at £1,455,516 (£1,457,907) of which £574,277 (£564,104) represented quoted securities having a market value of £539,180. Current assets, including cash of £205,210 (£227,659) amounted to £439,117 compared with current liabilities of £150,406, giving a net current asset figure of £288,711 against £279,423 in the preceding year.

COLLIERY INTERESTS

The company's South African coal interests, vested in the Tweefontein United Collieries, are currently enjoying the benefit of increases in the price for inland coal authorized by the Price Controller in September 1951 and June 1952. While these price increases came too late to materially affect Tweefontein United Collieries' results for the year ended December 31, 1951, they should enable a substantial improvement to be shown when the report and accounts for the year 1952 are submitted. This is, of course, contingent upon adequate truck supplies, for it was the shortage of railway trucks in 1951 which was responsible for the reduction in coal offerings to the South African market by some 105,000 tons compared with 1950.

Output of coal during 1952 amounted to 1,317,125 tons compared with 1,239,635 tons in 1951. Dividends were paid on the Ordinary Share Capital of 10 per cent (15 per cent) per share and on the Preference of 2s. per share.

As regards future operations at the collieries, plans are under active consideration for the exploration and establishment of further reserves of coal from the intact areas contiguous to the existing workings at Waterpan and Tweefontein. To this end boreholes are at present being drilled on Waterpan, and headings are being driven from No. 6 section of Tweefontein into a hitherto unproved portion of Kleinkopje.

It cannot yet be said what tonnage of coal is likely to be derived from these new sources but operations are progressing satisfactorily and prospects, so far as can be judged, are encouraging.

The effective demand for coal in South Africa continues strong and when exports of coal from the Union are again permitted, Tweefontein will be one of the collieries in a position to participate. Meanwhile, the domestic market, the development of the Orange Free State and the requirements of the Electricity Supply Commission absorb all available supplies.

INDUSTRIAL VENTURES

Amongst the industrial undertakings in which the company has an important stake is White's South African Portland Cement Co. which has fully justified the confidence shown in its prospects. Its works at Lichtenburg are large and modern and the results from its first complete year in full production showed that its capacity was well above and costs well below the original estimates.

The demand for cement in South Africa has exceeded supply, so

much so that contractors have been willing to send motor transport the 150 miles from Johannesburg to Lichtenburg to pick up cement which the railways could not transport. Even so inadequate coal supplies and railing facilities were directly responsible for the loss of almost 30,000 tons of cement production. Road deliveries from the Old White's factory to the developing mines in the Orange Free State have also been considerable and approximately 25 per cent of the combined output for both factories belonging to White's has, in fact, been delivered by this method.

Part of the company's expansion programme has been directed towards obtaining additional raw material and during the year it acquired a property containing a substantial quantity of reasonably high-grade limestone. This purchase will assist the new factory considerably, while at the same time playing a valuable part in helping to prolong the economic life of the older factory which is well situated to meet the demand for cement from the Orange Free State goldfield.

The construction work in progress in urban areas of South Africa and the amount of development generally indicate that the prosperity of the Union's cement manufacturers will continue for a long time. Consequently, it is abundantly clear that Henderson's substantial shareholding in White's is one of its most valuable assets.

MINERAL HOLDINGS

As an instrument which the company has used to conserve its minerals rights, farms and cognate interests, Mineral Holdings has proved to be very successful. It is a wholly-owned subsidiary in which is contained some of Henderson's valuable interests. They comprise concessions, land, etc. in numerous districts of the Transvaal and the Orange Free State. Additionally, it has the Havelock concession in Swaziland which became prominent by the formation of the "Swaziland" Concessions (Pty.) Ltd.—a small undertaking in which Mineral Holdings was allotted shares in consideration of granting the Syndicate the right to explore the concession for asbestos. The manifold uses to which this mineral is put and its importance in the industrial world urged the concessionaires to spend time and money in investigating the area. So far as asbestos was concerned their efforts were not successful but prospecting is still in progress and hope has by no means been abandoned.

In another direction, prospecting is taking place on the company's asbestos properties in the Middleburg District where fibre is already being produced on tribute. Steps have naturally been taken to ensure that in the event of the deposits proving sufficiently extensive to justify the flotation of a company to exploit them, a controlling interest as vendors will be retained by Mineral Holdings. Henderson's equity is, therefore, well protected in what may possibly prove to be a very valuable asset.

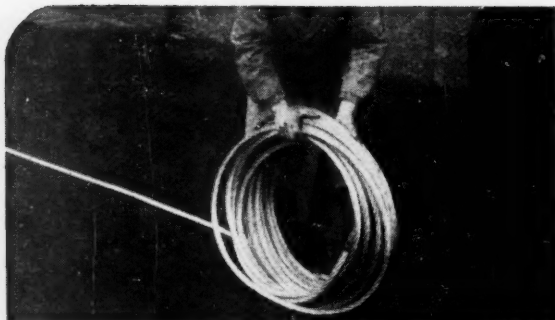
VRYHEID COPPER

Another potentially valuable asset owned by Mineral Holdings is the large copper-bearing property in the Messina district of the Transvaal adjoining the well-known Messina (Transvaal) Development Co. It covers a large area—some 9,000 acres in extent—and several geologists who have examined it on the company's behalf have expressed the view that the occurrences on it are similar in character to those of the adjoining Messina property. A geo-physical survey has been made and a drilling programme carried out which has indicated that underground development would be warranted. Ore channels have been identified and the existence of sulphide ore with a reasonable percentage of copper has been established. The channels have been identified at both the old Bat and River workings and plans have been worked out to test the ore.

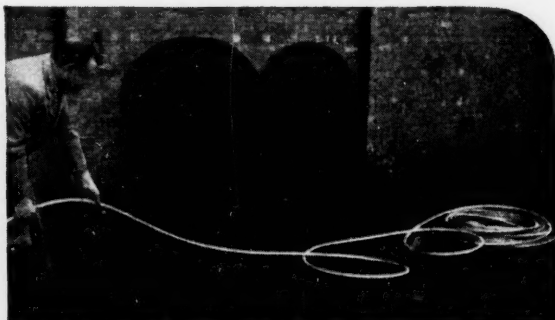
The matter of launching a major development has engaged the attention of the board for some time and an approach has been made to the Messina Co., which has ample supplies of power, equipment and staff, to collaborate in the development of the property. Being contiguous, it would be possible for that company to explore the ground through its own property. However, this must remain a possibility for the future as Messina, which is in the midst of its own heavy development programme, cannot, at present, spare the necessary time and resources to co-operate with the company. This is understandable, and although the matter rests for the time being, Henderson's Transvaal, through the administration of Mineral Holdings, does not intend to allow the opening up of Vryheid to be shelved. Hopes are entertained of being able to arrange for another prominent company, either to undertake the development programme as agents, or alternatively to collaborate in a joint venture. It is hoped that some arrangement will be concluded as there is sufficient evidence available to suggest the possibility that this large copper-bearing property could be developed into a successful copper producer.

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South-West Africa Co.

THE South-West Africa Co. runs on three legs. But unlike the Manx Man equal support is not obtained from all three. By far the greatest assistance is given to the company from revenue derived from its base-metal producing mine at Abenab West—although its investments in other mining and metal companies bring in a useful income. The third leg functions as a feeler, its purpose being to locate economically workable ore deposits within the 3,000 square miles Damaraland Concession area over which the company has exclusive prospecting and mining rights until 1957.

During the year to June 30, 1952, Abenab West mine continued to produce substantial tonnages of both gravity and flotation lead-vanadium concentrates. Lesser tonnages of zinc, wolfram and tin concentrates were produced from others of their mines.

An analysis of the ore sales account for 1951 and 1952 shows:

Year to June 30	Lead* (conc.)	Vanadium (conc.)	Vanadic† Acid	Zinc (conc.)	Wolfram (conc.)	Tin (conc.)
1952	£637,601	£230,038	£354,513	£141,868	£40,639	£15,428
1951	£436,586	£98,226	£273,176	£44,091	£7,232	£31,675

*Lead ex lead/vanadium concentrates.

†Fused vanadic acid from further treatment of the concentrates.

The relatively high metal prices during the year to June 30, 1952, undoubtedly accounted for a large proportion of the increase in receipts from the sale of its lead, tin and wolfram concentrates. But it is clear that the impressive rise in revenue from the sale of its vanadium concentrates, fused vanadic acid, and zinc concentrates was also due, in large part, to the company's increased sales of these products.

An analysis of the costs of producing principal products shows:

Year to June 30	Mining Costs	Refining Costs	Shipments* Cost	Pros- pecting Costs	Admin.† Costs	Total Costs
1952	£298,873	£259,956	£142,592	£31,230	£47,374	£780,025
1951	£221,242	£124,553	£40,256	£13,488	£29,192	£428,731

*Refers to ore shipment and charges by rail to Walvis Bay.

†Including headquarters and administration expenses and local taxes.

The statistics given in the above table call for little comment, the company's greatly increased scope of operations, larger output, higher freight charges, and the general rise in wages, salaries and materials accounting for the advance in the different factor charges.

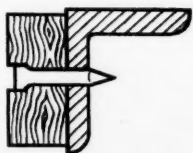
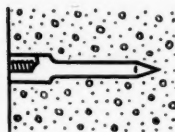
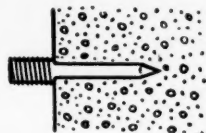
The company's second support—its investment income—is almost wholly derived from its holdings in Metallo Chemical Trust Co. and Tsumeb Corporation. Interest in the Metallo Chemical Trust Co. arises from the fact that a great deal of the concentrates are treated by two of the Trust's subsidiaries. This holding, amounting to £71,000 at cost, appears in the accounts under "Trade Investments" and dividend income received for the year to June 30 last was £5,325 against £4,583 in the preceding year. Income from "Other Investments" during the year totalled £67,165 compared with £40,187. This was mainly derived from its holding in Tsumeb Corporation which is registered in the balance sheet as having a book value of only £5,937.

The third leg is rooted in the land and consists of the company's 100,000 acres of freehold land and exclusive prospecting and mining rights over 3,000 square miles in Damaraland. This is not, of course, a direct revenue bearing item but its potential value could be very great indeed.

The profit and loss account for the year to June 30 last made an impressive showing. The gross revenue of £1,382,308 was made up of ore sales amounting to £1,301,627, investment income amounting to £72,490, and sundry receipts totalling £8,191. Mining costs were given in the above table, and after adding depreciation charges, allocations to pension funds and London expenses, total outgoings were £903,947. Tax attracted was much heavier but even so net profit at £157,778 was a record figure as was the dividend distribution of 8s. per 13s. 4d. share which required a net £111,679. Reserves were strengthened to £350,000 by a further allocation of £50,000, and the carry forward at the financial year-end was £42,717.

The company's financial position is sound. Net current assets amount to £362,878, or some £8,000 in excess of the issued capital of £354,538.

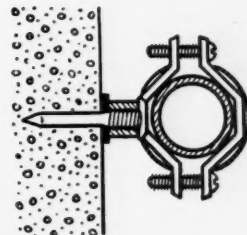
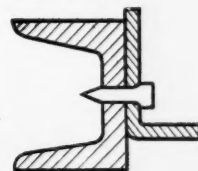
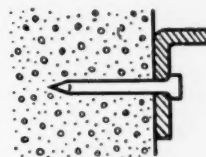
The results for the current year will not, in all probability, stand comparison with those obtained during the year under review. Market prices for lead, zinc, tin, and wolfram have all fallen appreciably. Consequently, as the chairman stated at the company's annual general meeting last December, shareholders must be prepared to see a considerable reduction in the current year's profits compared with those achieved during the year under review.



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East Rand Consolidated Ltd.

THE balance sheet of East Rand Consolidated at December 31, 1951, showed that by far the greater part of the company's assets was in investments and the profit and loss account showed overwhelmingly the influence of this type of asset. Although the quoted investments number 22, with a wide geographical and economic spread, E.R.C. is chiefly concerned with the fortunes of four companies in the South-East Rand. These are Spaarwater, which is under the technical management of New Consolidated Gold Fields, Witwatersrand Nigel, West Spaarwater, and West Vlakfontein. The latter company has just passed under the technical management of E.R.C., and the remaining two companies share African Exploration Co. as secretaries. The recent history of three of these companies is described on this page, the fourth company, West Spaarwater, being on a care and maintenance basis.

E.R.C. is continuing the policy of liquidating its non-income producing assets in favour of revenue-bearing investments or selected developing mines. For this reason the book value of its quoted investments in the balance sheet has been drastically written down to £577,406 at which level it was, at that date almost identical with their market value of £583,673. This is in sharp contrast to the end of 1950 when investments stood in the books at £1,392,375 with a market value of £660,015. As a result of this pruning operation there remained a net debit balance on Profit and Loss Account of £722,078 to be carried forward into 1952. Unquoted investments comprise shareholdings in New Consolidated Free State Exploration Co. Ltd., in Olympus Consolidated Mines and African Exploration Co. Ltd. The latter two companies are subsidiaries of E.R.C., Olympus owning a gold mining property in Southern Rhodesia, while African Exploration Co. provides secretarial and consultant services in South Africa.

E.R.C.'s other main assets consist of mineral rights over 2,023 morgen in farm Maraisdrift No. 4 due south of the Spaarwater property, 604 morgen in farm Klippoortje 228 due south of West Spaarwater, and 12,663 morgen in the Lydenburg and Belfast districts. It also held options over large areas in the Orange Free State, but after examining drilling results, most of these options were allowed to lapse, only 1,952 morgen being retained, except for the purchase of the mineral rights over 191 morgen on farm Moedersgift immediately adjacent to the southern boundary of the lease area held by Merriespruit G.M.

WITWATERSRAND NIGEL LTD.

This company works a large property on the edge of the South East Rand and owns 14,739 claims, the majority of which are mineral claims. Originally the company owned a smaller area but the acquisition of a section, known as Poortje No. 123 added greatly to the area held but made necessary the sinking of another shaft, designated No. 7 vertical, and the erection of a new plant to deal with ore from the Poortje farm.

This new mill to deal with the ore from the Poortje farm area came into operation during April, 1952, since which time results have been much better. The amount of ore treated rose by 16,900 tons, virtually by the amount of Poortje ore treated, enabling costs to be spread over a greater tonnage. The benefits derived from this additional expenditure have been restricted, however, because the full capacity of the plant of 7,000 tons per month cannot be used owing to the shortage of electricity.

Development results in the first 10 months of the current year are much the same as in the corresponding period of 1951-52, but the operating results are much more encouraging. The tonnage treated has jumped to 168,800 against 104,100 and the amount of gold recovered is 38,073 f.oz. as compared with 25,803 f.oz. This improvement has raised working profits to £76,531 from £13,215, and the early payment of a small distribution to break the long dividendless period seems feasible. This would mark quite an important event in the company's life, for the policy of providing recent capital expenditure amounting to £254,028 out of internal finances has kept the reorganized capital low and shareholders will benefit from their earlier abstinence.

Capital expenditure is not entirely at an end, for mining conditions on the lower levels of the area served by No. 1 shaft in the Houtpoort section are becoming difficult owing to the distance between the present workings and the bottom of the vertical shaft. A new shaft nearer the workings will be necessary in the near future. Be that as it may capital expenditure for the March quarter of this year only amounted to £2,301.

	1950-51	1951-52
Tons milled	119,900	136,000
Yield per ton, dwt.	5.098	4.807
Working costs per ton (inc. cost of development)	60s. 10d.	58s. 7d.
Working Profit	£31,417	£22,258
Capital Expenditure	£28,002	£120,665

The ore reserves at June 30, 1952, were estimated at 690,000 tons, averaging 4.4 dwt. per ton over a width of 37 in. This result is an improvement of 29,000 tons over the previous year; the grade is, however, 0.1 dwt. lower.

SPAARWATER GOLD MINING CO. LTD.

Spaarwater holds an area of 5,012 claims in the Heidelberg district of the South-East Rand. Although the ore it treats is not so rich as the neighbouring Sub Nigel property, it is above the average for the whole of the Transvaal. On the other hand, the amount of ore treated in its 11,000 tons per month reduction plant is amongst the smallest and hence the excess of revenue over mining and milling costs—£103,479 in 1952—is not very large when compared with the £2,000,000 issued capital.

Unfortunately, this surplus is lost by the necessity of spending large sums on development. In 1952, £123,257 was so spent, turning this working profit into a working loss of £19,778. Moreover, development results in the latter half of 1952 have been disappointing. In the western section of the mine, development on the 37 West Haulage was hampered by ventilation difficulties and the steep dip of the reef. Payability is on the low side partly because the reef here is in the nature of pay shoots rather than a more regular ore body. But 33.6 per cent of the 1,145 ft. sampled had the high value of 11.3 dwt. over an estimated stoping width of 36.4 in. or 411 in.-dwt. Subsidiary development carried out from the haulage gave 21.3 per cent payability with the very satisfactory values of 16.2 dwt. over an estimated stoping width of 36.0 in. or 583 in.-dwt.

Work from the North-West Haulage gave less satisfaction and development in the eastern section of the mine was mainly confined to the opening up of known pay zones for the purposes of augmenting the ore reserves. These showed a sharp deterioration, total reserves at the end of 1952 being 49,000 tons lower at 126,000 tons—the falling off of 0.1 dwt. in the grade being balanced by the increase of 0.6 in. in width.

Since the close of the year, however, subsidiary development on the 37 West Haulage has continued and during the March quarter footage sampled amounted to 1,190 ft., of which 475 ft., equal to 39.9 per cent, proved payable at an average value of 10.1 dwt. per ton over an estimated stoping width of 36.0 in.

Operations in 1952 were hindered by the industry's chief shortages—electric power and native labour, while costs of stores rose in common with other producers. The following summary gives a comparison of the last two years development:—

	1951	1952
Tons milled	124,800	127,000
Total yield, f.oz.	28,226	28,546
Yield per ton, dwt.	4.523	4.495
Total revenue	£368,341	£364,963
Mining and milling costs	£252,160	£261,484
Excess of revenue over mining and milling costs	£116,181	£103,479
Development Costs	£124,948	£123,257
Working loss	£8,767	£19,778
Development footage	15,009	14,133
Ore reserves:—		
Tons	175,000	126,000
Value dwt.	5.6	5.5
Width in.	36.5	37.1
In.-dwt.	204	204

WEST VLAKFONTEIN GOLD MINING CO. LTD.

Covering 5,685 claims lying in the South-East Rand this company's property is adjoined by the areas owned by Withok Proprietary, Vlakfontein Gold, Sub Nigel, Spaarwater and West Spaarwater.

At one time hopes were entertained that the reef would extend from one of these properties into the company's area. A shaft was sunk and development work was carried out on a limited scale in the eastern part of the mine but the results obtained by mid-1950 were such as to cause the company to cease underground development. An arrangement was made between the company and Vlakfontein whereby the latter company would keep the mine free from water in return for the use of the shaft for ventilation purposes. Drilling was carried on in the western parts, but the results were discouraging and the company's then technical advisers, New Consolidated Gold Fields, recommended in March, 1953, that all prospecting operations should stop. This recommendation was accepted and East Rand Consolidated thereupon assumed the position of technical advisers to the company in place of New Consolidated Gold Fields. It appears that the company will now wait to see if any of its neighbours strike significant pay shoots near its boundaries.

Rhodesian Corporation Ltd.

ALTHOUGH Rhodesian Corporation's interests can be classed under three main heads: mining, agricultural and real estate operations, and investments, the Corporation must be chiefly viewed as a mining finance house and its investment activities, therefore, claim prior consideration.

At present, the Corporation has two major investments, namely, Falcon Mines and Rhodesian Brick & Potteries. A review of the recent progress made by Falcon Mines is given below and it only remains to state that this company is fast approaching the time when it will be contributing to the Corporation's revenue.

With regard to Rhodesian Brick & Potteries, the Corporation together with the Brick & Potteries Co. of South Africa sponsored its formation. Rhodesian Brick & Potteries has works in full production at Bulawayo and a second works at Salisbury. The first tunnel kiln at Salisbury commenced last January, and the construction of the works will soon be finished and in full operation.

To date, both of these enterprises have required that profits be ploughed back to finance capital expenditure programmes but now that these are virtually completed the Corporation should soon begin to reap material benefits.

The Fred and Redwing Mines are the only mining ventures now directly worked by the Corporation. The Fred Mine, which has been in continuous operation since before the first world war, came to an end of its producing life in 1951 although reclamation work continues to be carried out. At the Redwing Mine, development operations during the year to September 30 last were concentrated on sinking the main shaft to below level 8 at which depth development work was restarted. In the course of sinking the main shaft, the ore body was intersected on level 6, assaying 4.2 dwt. per ton (unreduced) over a width of 276 in., and on level 7 where a drive east yielded 7.5 dwt. per ton (unreduced) over a width of 66 in.

The third main source of the Corporation's revenue is derived from its agricultural and real-estate interests. At the end of September last, the Corporation owned 43,420 acres of land in Southern Rhodesia and Jameson Park, a developed township in South Africa. Of its total acreage in Southern Rhodesia, 16,336 acres adjoin Salisbury and Bulawayo townships. The remaining area is devoted as between tobacco growing and general agriculture and the rearing of livestock.

Falcon Mines Ltd.

ALTHOUGH Falcon Mines has not paid a dividend since the year ended September 30, 1948, the absence of the company from the list of dividend payers during the past four years has not been due to any reduction in its profits or to an ultra-conservative dividend policy. In fact, earnings from Sunace and Bay Horse, Falcon's two regular producing mines, which made possible the 5 per cent distribution in 1948 out of earnings of nearly 10 per cent, have been substantially better. Indeed, as shareholders have been told time and again, all available profits have been pledged to financing the task of bringing the Dalny Mine into production. This was achieved on June 3, 1952, when the permanent reduction plant, having a nominal capacity of 12,000 tons per month, was started up. On the same date the small 100 tons per day pilot plant was shut down.

While Dalny's full earning potential will not be realized for some months to come, its beneficial effect on the company's financial position was apparent even after only four months operation during the year ended September 30, 1952.

Year to Sept. 30	Mining Profit	Gross Revenue	Expenses	Net Profit	To Reserves	Carry Forward
1952	70,030	75,691	8,781	66,910	120,000	10,066
1951	51,565	58,347	8,210	50,137	50,000	63,374
1950	52,202	61,027	9,263	51,764	50,000	63,537

The improved results for the year ended September 30, 1952, are, of course, only a foretaste of what shareholders can expect when the company has all the factors of production under its own control. The situation at present is that—apart from the usual mechanical troubles encountered during a running-in period—the reduction plant was started up without a roaster and without the necessary plant to treat flotation tailings.

However, in November last the plant for treating flotation tailings was brought into commission, resulting in an improvement in gold recovery, though gold absorption was still taking place. But the roasting unit which is on order has yet to be delivered and in the interim period the company are sending the maximum permitted amount to the government roaster at Que Que and stockpiling the remainder.

Meanwhile, it is instructive to view the technical position of the Dalny Mine, bearing in mind that the position as outlined in the table below has been accomplished with the assistance of

The profit and loss account for the year ended September 30 last brings the Corporation's three main sources of revenue into a proper financial perspective. However, since the preceding accounting period covered 14 months comparisons are not strictly valid.

The general result of the year's activities was good and total income from all sources at £102,816 compared with £84,583 for the preceding 14 months period. The chief contribution to this total came from dividends and interests received amounting to £25,494 against £19,364. Profits from share dealings declined to £25,030 from £45,956 but as this was achieved in a falling market it must be considered satisfactory. Net revenue from mining operations amounted to £5,153 compared with £1,654. Profit from the sale of properties brought in £7,388 (£30,625), and net proceeds received from its agricultural, ranching and real-estate activities advanced to £22,585 compared with a loss of £4,597.

The net profit for the year, after providing for all outgoings including £11,299 (£16,873) for depreciation and £3,325 (£3,096) for taxation, improved to £64,347 compared with £39,450 in the preceding year. This good result enabled the company to return to the list of dividend payers, for the first time since 1935-1936, with the payment of 7½ per cent which required a net amount of £38,500. Investment depreciation reserve was strengthened to £75,000 by the allocation of £15,000 out of the year's earnings, leaving the carry forward at £43,556 compared with £32,709.

While any considerable expansion in revenue during the current year must depend on whether Falcon Mines and/or Rhodesian Brick & Potteries have reached the dividend stage, there is no reason to suppose that the end-year result will be less impressive than that for the year under review. The market for share dealing transactions has been decidedly better in recent months, profits from tobacco sales should be maintained from the 450 acres under cultivation, and the Redwing Mine will have the assistance of premium revenue from the sale of its gold output for the full year instead of from only five months as was the case during the year under review.

Whether or not this assessment is correct, the Corporation has already declared an interim dividend of 2½ per cent in respect of the current year ended September 30, 1953.

only one additional capital increase. This took place in March 1950 when issued capital was increased from £259,373 to its present total of £453,903 divided into shares of 5s. each.

Year to Sept. 30	Milled (tons)	Per. Grade (dwt.)	Ton Yield (oz.)	Milled Cost* s. d.	Capital† Expenses £	Ore Reserves (000 tons)	Grade (dwt.)
1952	62,300‡	2.55	7,950	29 0	139,147	536	4.0
1951	28,070§	3.11	4,365	34 3	243,000	483	4.2

*Includes development charges. 1952—4s. 11d.; 1951—5s. 2d.

†Capital expenditure, 1949-50, was £139,280.

‡Including 4 months operation of main reduction plant.

§10 months operation with pilot plant.

The above figures clearly bring out where the ploughed back profits have been absorbed; that at the full crushing capacity of 144,000 tons per annum ore reserves are sufficient for 3½ years; that currently profits are being obtained from ore well below the grade of the ore reserves.

The company's two regular producers, Sunace and Bay Horse, continue to give satisfactory results. During the year ended September 30, 1952, Sunace crushed 27,100 tons (25,800 tons), the grade of ore also being higher at 6.22 dwt. against 5.57 dwt. yielding a working profit of £45,813 compared with £37,719. Bay Horse sent 9,600 tons (8,860 tons) to the mill, the grade being slightly lower at 4.46 dwt. compared with 4.73 dwt. in the preceding year, giving a working profit of £7,220 against £7,329. The ore reserve position at both mines is fairly good, supplies being sufficient at Sunace for nearly 2 years and over 3 years at Bay Horse at present crushing rates.

The outlook for Falcon Mines during the current year is distinctly bright. Revenue from premium gold sales will be available for the full period instead as from only 5 months as was the case during the year under review, which amounted to £12,335. Dalny will be in full production. The roaster unit is expected to be in commission sometime this year and the milling rate at both Sunace and Bay Horse is to be stepped up. A distribution should not be expected during the current year as its liquid resources position has been severely strained, the balance sheet at September 30 last recording current liabilities of £73,164 against current assets of only £28,997. Even so all signs point to shareholders' patience being amply rewarded in the not too distant future.



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London & Rhodesian Mining and Land Co. Ltd.

WITH an interesting spread of assets, this well-established mining finance undertaking continues the steady progress which has characterized it for many years. It holds mining investments, principally in gold-producing companies, it operates mining properties, has real estate, ranching and agricultural interests, while it has more recently branched out into a new venture—tobacco-growing. From these various sources it derives a steady revenue.

Additionally the company acts for other undertakings, including a group of associated companies headed by Henderson's Transvaal Estates, whose variety of capital interests are mentioned in a separate article elsewhere.

In Salisbury the company has an organization where it accommodates mining, trading and investment companies. It acts as secretaries, consulting engineers and in certain cases, as managers. It has under its aegis the Cam & Motor Gold Mining, and the mines of the Coronation Syndicate which are working in different parts of the country.

ENCOURAGING OUTLOOK FOR RHODESIA

The outlook for Rhodesia is regarded as encouraging, and the prospects for companies engaged in mining, agricultural and industrial activities, satisfactory. This should react to the benefit of those enterprises trading in the country—and that it does so, is evident from the consistent results which London & Rhodesian has been able to show over a long period.

For the year ended June 30, 1952, the consolidated income of the company and its subsidiaries was £203,997 as against £203,731. Dividends brought in about the same but less favourable conditions in the market reduced the profit from share dealings from £47,066 to £17,984. Some part of the loss of income from this source was made good by greater revenue from farming and a contribution was forthcoming from tobacco. Property rentals brought in £3,722 and mining, £14,585. There was not a great change in the income from sale of properties but a big credit item was from the sale of Mining Claims—£30,031, whereas the previous year nothing was derived from this source. A subsidiary undertaking which acts as secretary to the company earned a profit of £16,338 and paid a 5 per cent dividend. The parent company's profit was £85,063 (against £95,479), and with the balance brought forward, there was an available amount of £120,193. Taxation called for £46,765 and the company was well able to maintain its dividend of 6 per cent, to which it was raised from 5 per cent the previous year. This called for £31,500, leaving £34,698 to be carried forward after transferring £7,230 to General Reserve.

SPREAD OF INVESTMENTS

Amongst its most prominent investment holdings are Henderson's Transvaal Estates, Cam & Motor Gold Mining, and Rezende Mines. The former controls the Henderson Consolidated Corporation Ltd. and one of its main assets is the Tweefontein United Collieries Ltd. with a production of the order of 1,350,000 tons of coal per annum. Another profitable holding is a substantial stake in White's S.A. Cement Ltd. Henderson's Transvaal showed a net profit for the year to March 31, 1952 of £45,013, and maintained its dividend at 15 per cent, which it paid for the previous five years.

Cam & Motor earned a net profit for the year to June 30, 1952 of £328,792 compared with £251,914 and paid dividends totalling 4s. 6d. per share.

A larger tonnage was dealt with—269,500 compared with 244,500, and there was an advance in the recovery of gold. The rise of 1s. 4d. per ton in unit costs was well taken care of by the revenue per ton which rose from 55s. 6d. to 61s. 8d. Developments progressed satisfactorily in the lower levels, and a pilot flotation plant installed has resulted in increased gold extraction; from the mining angle, the company's outlook is very promising. Ore reserves are now standing at 1,483,300 tons of 6.9 dwt. The company has purchased the Pickstone mine which is situated within easy distance of it—about 17 miles.

The market in Cam & Motor shares has become broadened by the sub-division of the 12s. 6d. stock units. They have been split into 2s. 6d. un-numbered shares, in which form they make their appeal to mining investors.

The best working profit for several years was announced by Rezende Mines for 1951—£15,566 against £13,264. There was a drop in tonnage but the average value of the ore milled was higher. New ore opened up on Rezende was more than sufficient to replace the tonnage milled and reserves were increased to 203,700 tons of 3.8 dwt.

Since the mines of Rhodesia have been allowed to dispose of

their product in the free market for dollars, they have been better able to withstand the rising level of working costs.

The premium on gold has, however, undergone considerable fluctuations which, in the case of some producers, has hindered operations. Cam & Motor, Rezende and other mines in which London & Rhodesia are interested, have been able to work profitably and the outlook at the moment, appears to be quite good.

MINING PARTICIPATIONS

The company's direct mining participations in Southern Rhodesia comprise 100 per cent interest in 556 gold mining claims and a 75 per cent interest in 145 base metal claims. The company is always on the look-out for other acquisitions and has at present an option over additional base metal claims with a view to carrying out exploratory work in order to establish the existence of payable asbestos deposits.

The participation taken some years ago with other companies in the Pickstone mine turned out to be a profitable one. After being opened up and preliminary development work carried out, the property, situated within easy distance of Cam & Motor, was sold to that company for £200,000. It was always contended that the mine would be worth more to a mining company already operating in the vicinity, which would not be faced with the heavy capital outlay that new participants in the venture would have had to face. A deal of money had been spent in testing the property prior to its sale to Cam & Motor. The sale was regarded as a judicious one in all the circumstances; it relieved those interested from a big obligation and resulted in a profit; that obtained by London & Rhodesian amounted to £30,997.

RANCHING, AGRICULTURE AND TOBACCO

A big acreage of land is still retained by the company, and after disposing of a small portion last year, its holding remained at 1,015,568 acres. Land in Rhodesia is increasing in value, and in this holding the company has a very satisfactory asset.

Important stands are held in Bulawayo and Salisbury, two of Rhodesia's biggest towns. They were acquired many years ago and have since appreciated in value. On three of them in Bulawayo, flats and business premises have been erected and regular investment income is derived, while flats and offices have also been built on those owned in Salisbury.

The company has two ranches—Lochard and Wiltshire, and a large head of cattle from which it derives income. It also has an agricultural section.

Drought has been the bugbear of ranching in Rhodesia for many years and has resulted in heavy losses to those carrying on farming and cattle rearing. The board of London & Rhodesian, however, in its progressive policy, has forestalled this great handicap by making provision for adequate supplies of both water and food. Boreholes have been put down on the ranches, which are now supplied with several dams with capacities reaching several million gallons. Their combined capacity, when aggregated with supplies of water derived from successful boreholes, have helped materially to overcome this difficulty.

With regard to additional supplies of food for the cattle, large acreages have been broken up on the ranches and cultivated. They produce crops suitable for winter feed consisting of maize, hay, sorghum and ensilage. Substantial capital expenditure has necessarily been incurred but results have been very satisfactory and in addition to large sections, small arable areas have been cultivated.

In order to control grazing, the ranches have been split up into smaller paddocks and separated by barbed wire fencing.

EXPANDED TOBACCO GROWING

The strong demand for tobacco for the sterling area encouraged the company to allocate an acreage suitable for the purpose of tobacco growing. Fifty-five acres have been planted and doing well, and it is proposed to plant a further area. The barns necessary for drying the crop have been erected.

Some idea of the expansion of tobacco-growing in Rhodesia can be gauged from sales last year of flue-cured tobacco at the auctions in Salisbury. 96,576,633 lb. were sold for £17,235,725 at an average price of 42.83d. per lb. Buyers for the United Kingdom market secured 62,289,012 lb. It is now estimated that the colony will produce not less than 125,000,000 lb. in the present season.

Markets for about 70 per cent of Southern Rhodesia's total expected tobacco production over the next five years are assured by agreements with British and Australian manufacturers and the Rhodesia Tobacco Marketing Board.

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British South Africa Co.

THE centenary of the birth of Cecil Rhodes this year serves as an apt reminder that the British South Africa Co.—familiarily known in the markets as “Chartered”—was formed by Rhodes under Royal Charter in 1889.

With such an ancestry, it was inevitable that the company would exercise an abiding influence in promoting British standards of colonization though, of course, seen against a wider horizon, political, economic and commercial affairs have all come within the ambit of its power. Its influence, pervading and ubiquitous, has been a prominent feature of Rhodesia's development. Inevitably, perhaps, it has gradually lost most of the prerogatives held under the original Royal Charter. But if this signifies a less potent political influence it also indicates a corresponding growth of importance in the Colony's mining industry. To-day, it can be regarded in much the same way as any other large well run investment holding company with the exception that it still holds the mineral rights in Northern Rhodesia until 1986. During this time it has contracted to pay to the Northern Rhodesian Government 20 per cent of its net royalty revenue, which ranks as an expense for tax purposes.

The fact that these important mineral rights will expire some 33 years hence has led the company to re-orientate its long term policy and for the past three years it has concentrated on fattening its portfolio of investments, chiefly in Southern Africa.

The company's fortunes are closely bound up with the Northern Rhodesian copper belt companies, whose prosperity during the past two years has been unprecedented. It was, therefore, expected that earnings from Royalties, which are geared to the price of copper, would be high. This, in fact, was the case and revenue expanded from £5,500,771 to £7,066,386. Moreover, investment income advanced from £825,825 to £1,268,041 and after taking into account all other income items, gross revenue at £8,607,727 was £1,906,384 higher than in the preceding year (£6,701,343).

General expenses, though approximately £55,000 higher at £297,797, were easily absorbed. But the crushing burden of taxation of no less than £5,932,951 (£3,978,134) nullified any advantage which might have accrued from the expansion in revenue. Of the total tax liability, E.P.L. which was operative for only nine months of the company's financial year, took as much as £950,000 against nil. Consequently, net earnings were reduced to £2,674,776 against £2,723,209.

The dividend was maintained at 6s. per 15s. share, equivalent to 40 per cent, which required £1,379,779 and the amount to be carried forward was £4,614,557 against £3,319,560 brought in.

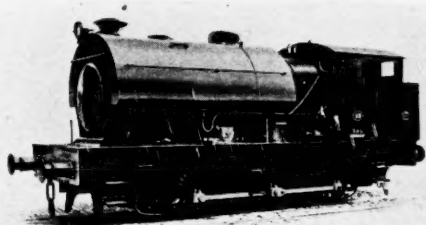
The consolidated balance sheet reflected solid strength; Group assets totalled £26,710,149 compared with £23,065,953 in the preceding year. This was an increase of £3,644,196 of which £2,325,256 was accounted for by a growth in investments from £13,419,642 to £15,744,898. In this connection holdings in mining companies, other than Rhodesian, went ahead from £3,467,767 to £5,003,478—an increase which accounted for most of the addition to its total of quoted investments made during the year. The book value of these holdings rose from £11,470,307 to £13,245,544—indicative of the company's need to cast its bread over wider waters in order to offset the loss in 1986 of its Royalties from mineral rights in Northern Rhodesia.

OTHER VARIED INTERESTS

A large and important interest is held in The Rhodesia Railways Trust. A participation of potential value is that held in Rhodesian Alloys, a company sponsored by John Brown & Co., the Clydeside steel-makers and shipbuilders. Other industrial ventures include Spa Food Products which manufactures fruit drinks, the products for which are obtained from the company's citrus estates. A half interest is also held in The Rhodesian Milling & Manufacturing Co., which, with subsidiaries, supplies more than half of the flour consumed in Southern and Northern Rhodesia.

The company is closely associated with the important South African mining groups. It has substantial investments in the Rand, the “West Wits” group and has acquired holdings in Orange Free State mines. It is also associated with the two big copper mining groups in Northern Rhodesia in prospecting large areas in the north of the Territory. Apart from this the Rio Tinto Co. were recently granted exclusive prospecting rights over three large areas further south, amounting in the aggregate to some 7,500 sq. miles.

While the company will thus obviously be very much interested in the current and projected expansion of activities on the copper-belt, increasing attention will be paid in the years ahead to building up its investment portfolio and the sharp increase in its investments recorded in this year's report and accounts may well become a recurring feature.



• STEAM

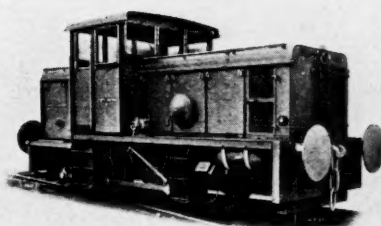
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Tanganyika Concessions Ltd.

SINCE its formation by the late Sir Robert Williams, Bt., in 1899, Tanganyika Concessions Ltd. has carried out and been responsible for a great deal of exploratory and development work in various parts of Africa. The most successful of these projects were the discovery of important mineral deposits in a Concession obtained by Sir Robert Williams in the Belgian Congo, which led to the formation of the Union Minière du Haut-Katanga, and the construction of the Benguela Railway across Angola, linking up with the Bas Congo du Katanga Railway at Dilolo to provide an economic outlet for Belgian Congo products to the west coast at Lobito, and a direct route for imports. Northern Rhodesian and East African interests have been maintained, through Tanganyika Holdings Ltd., in Rhodesia-Katanga Co. Ltd., Kentan Gold Areas Ltd., Geita Gold Mining Co. Ltd. and Uruwira Minerals Ltd.

The company has an authorized capital of £10,000,000 of which £5,676,036 has been issued in the form of £3,831,412 Ordinary Stock in units of 10s., and £1,844,624 representing 2,305,780 8 per cent Cumulative Redeemable Preference Shares of 16s. each. The transfer of the company's seat of management and control to Salisbury, Southern Rhodesia in November, 1950, has provided valuable financial advantages, and with increased earnings during recent years, excellent results have been shown since the change of domicile.

The year ended July 31, 1952, resulted in a profit after taxation of £1,827,390, as compared with £1,101,676 for the year ended July 31, 1951. In addition, the sum of £168,650 was credited to Capital Reserve Account, as against £218,700 for the previous year, arising from profit on redemption during the year of 4 per cent Income Debentures of the Benguela Railway Co. The increase in profits was mainly due to the increased revenue received from the Union Minière du Haut-Katanga by way of dividends and interest at £1,276,645, and Royalty at £399,221, as well as the receipt of £321,383 by way of interest on Benguela Railway Co. Income Debentures. Southern Rhodesian income tax was provided for in the sum of £150,000 as against £3,300. Dividends on the 8 per cent Preference Shares absorbed £147,570 and 30 per cent on the Ordinary Stock £1,149,424. In addition, a Special Dividend of 10 per cent was paid out of Revenue Reserves.

The main holdings of the company at July 31, 1952, consisted of 179,760 parts sociales, 61,384 4½ per cent Obligations of Fcs.B.100 each, and voting rights of Union Minière du Haut-Katanga, and 2,700,000 shares of £1 each (being 90 per cent of the issued capital) and £4,827,540 4 per cent Income Debentures of the Benguela Railway Co.

UNION MINIERE DU HAUT-KATANGA

The successful pursuit of the many activities of the Union Minière du Haut-Katanga resulted in that company distributing a dividend of Fcs.1,000 net per part sociale for the year 1951, as compared with Fcs.750 net per part sociale for the year 1950. Mining extraction during 1951 amounted to 4,762,000 tonnes of ores of all kinds, including copper, cobalt, zinc and uranium, as well as limestone and ironstone fluxes for smelting purposes. In addition, 6,800,000 cu. metres of barren-overburden were stripped from open-cast mines. The quantity of metals in new ore developed during the year exceeded that of the ore mined. The copper and cobalt outputs were again a record, and amounted to 191,959 tonnes and 5,715 tonnes respectively. Zinc concentrates containing a total of approximately 80,000 tons of zinc were also produced, together with 24 tonnes of cadmium. The production of uranium-radium ores was continued, the radium being extracted in Belgium by the Hoboken Metallurgical Co. This company also delivered 118,046 tonnes of silver and 14.7 kg. of gold which were recovered during the process of refining copper. Concentrator and refinery equipment continues to be extended in order to increase the capacities of the plants. The policy of providing hydro-electric power stations to produce the electric power necessary for the company's activities is being continued, and besides the Del-commune power station in the Nzilo gorge on the Lualaba River, forecasts of future power requirements have justified the decision to construct a second power station lower down the Lualaba, to be known as Le Marinel. It is planned that the first group in this power station will be started up during 1957, and when complete the four hydro-electric stations then in operation would have a

total capacity of 530,000 k.v.a. and give a production of the order of 2,500,000,000 k.w. hour units in an average year.

BENGUELA RAILWAY CO.

The substantial increases in the international and mineral traffic of the Benguela Railway which have been noticeable in recent years, continue to be maintained. The management has been able to deal with the expanding traffic to and from the Belgian Congo by the delivery of equipment ordered under the 1948/1951 capital programme, and the cost has been met partly out of revenue and partly by the increase in loan advanced by Tanganyika Concessions Ltd. from £539,726 to £1,400,000 during the year ended July 31, 1952. The capital expenditure programme of the Railway Co. for the years 1952/1954 inclusive, totals £4,000,000, and it is hoped that these additional capital requirements can be financed out of the earnings of the Railway. The net revenue of the Railway Co. for 1951 amounted to escudos 97,031,154.13, as compared with escudos 67,427,587.59 in 1950. There is no doubt that the Benguela Railway has contributed materially to the development of Angola and the Belgian Congo, and there is every reason to believe that besides continuing to assist these territories, it will, in the future, increasingly serve in the development of Northern Rhodesia.

TANGANYIKA HOLDINGS LTD.

Tanganyika Holdings Ltd. was formed by Tanganyika Concessions and The Zambesia Exploring Co. Ltd. (q.v.) in 1950, each company taking a 50 per cent participation, for the purpose of taking over the Northern Rhodesian and East African interests of those companies, including Rhodesia-Katanga Co. Ltd., Kentan Gold Areas Ltd., Geita Gold Mining Co. Ltd., and Uruwira Minerals Ltd.

RHODESIA-KATANGA CO. LTD.

The further exploration of the Kansanshi Mine in N.W. Rhodesia has been vigorously pressed forward under the technical direction of the Anglo American Corporation. The first progress reports indicate that no assessment of the potential value of the property can be made until the completion of the work to be carried out during the period of the option, expiring on December 31, 1955, granted to the newly-formed Kansanshi Copper Mining Co. Ltd. This company has been registered in Northern Rhodesia with an authorized capital of £875,000, and Rhodesia-Katanga will receive 30,000 shares of £1 each free of cost out of the initial issued capital of £187,500. If the option is exercised, the remainder of the authorized capital will be issued and Rhodesia-Katanga will receive £250,000 in cash and a further 250,000 shares free of cost, making a total holding of 32 per cent.

GEITA GOLD MINING CO. LTD.

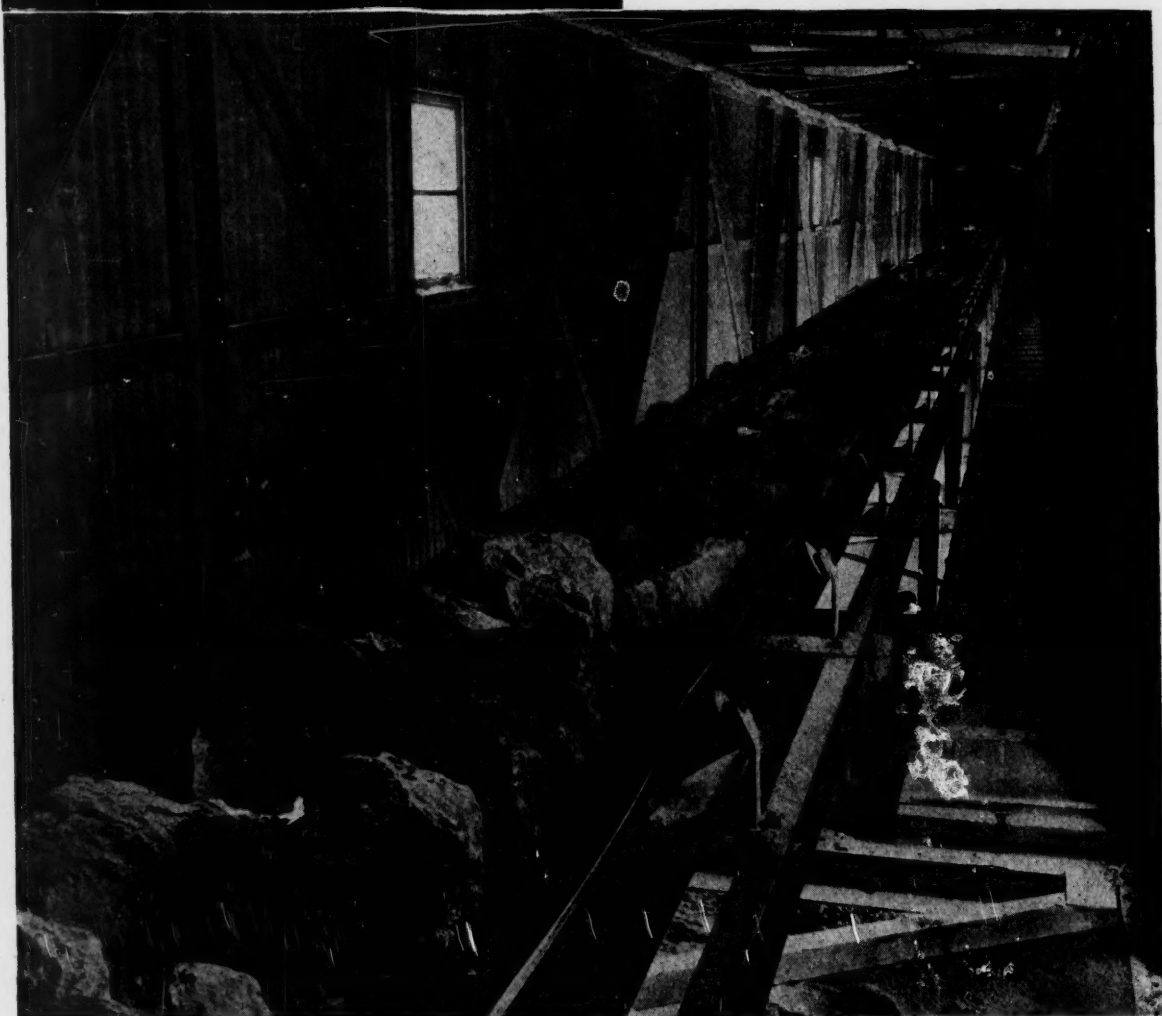
The Geita Gold Mining Co. Ltd. is the main asset of Kentan Gold Areas Ltd., which holds almost 90 per cent of the issued capital, and has produced gold since 1939 from its mine in Tanganyika Territory. New Consolidated Gold Fields Ltd. have been appointed Consulting Engineers for a period of two years from August 1, 1951, and have published their report on operations for the year to June 30, 1952. 212,600 tons of ore were milled during the year at an average yield of 3.05 dwt. gold per ton, and an operating profit of £39,416 was realized. A programme of diamond drilling and development, supplemented by additional sampling, has been inaugurated for the purpose of obtaining a more accurate valuation of the ore blocks. Pending completion of this, the ore reserves were estimated at 1,912,785 tons at a grade of 3.7 dwt. per ton.

URUWIRA MINERALS LTD.

Uruwira Minerals Ltd. is engaged in mining lode and alluvial lead and other minerals at Mpanda, Tanganyika Territory. Loans of \$1,640,000 and £200,000 have been obtained from the United States Government to finance the erection of a production mill capable of treating 1,000 tons of ore daily. Full production should be attained by July, 1954, and the loan, with interest, is repayable within three years by the delivery of copper and lead metals. A pilot mill is in operation pending the installation of the full plant. During the year ended March 31, 1952, revenue from sales of concentrates exceeded expenditure by £52,719, and ore reserves were estimated at July 31, 1951 to amount to 3,000,000 tons.

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Photograph by courtesy of The Washington Chemical Co. Ltd., Co. Durham.

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The Zambesia Exploring Co. Ltd.

THE functions of the Zambesia Exploring are those of a mining-finance company, mainly connected with Northern Rhodesia and East African enterprises. The company traces its origin back to the early days of 1891 when it was formed by the late Sir Robert Williams principally for the purpose of acquiring mining claims, land and town plots in Salisbury, Umtali and other places in Rhodesia which were then practically undeveloped. The company has always been identified with Tanganyika Concessions, as it participated in its promotion in 1899, and has continued to be associated with it in joint business enterprises.

A modern link in its liaison with Tanganyika Concessions was forged about two years ago when that undertaking's capital reorganization was brought about. A wholly owned subsidiary was formed called the Zambesia Investment Co., to which the Exploring Co.'s "reconstructed" holdings in Tanganyika Concessions, consisting of Preference and Ordinary stock units, were transferred as a fixed investment. Zambesia Exploring also co-operated with "Tanks" in the formation of Tanganyika Holdings.

As a result of this hiving off of interests, Zambesia Exploring's fixed assets now consist of properties in Africa, its wholly owned subsidiary, the Zambesia Investment Co., and its 50 per cent interest in Tanganyika Holdings Ltd., all standing in the balance sheet at £858,114. Current assets include quoted stocks and shares at cost, £455,965—their market value at December 31, 1952, being £660,292. Cash at bankers, at the same date, stood at £74,694, with loans, debtors and Tax Reserve Certificate amounting to £74,081. Current liabilities totalled £146,021.

During 1952, total revenue, excluding that of the wholly-owned subsidiary, showed a decrease at £103,469 while the profit, after providing for all charges, including tax liabilities amounting to £62,798, was £29,101 against £91,609. The distribution was 15 per cent (including 5 per cent bonus), and the balance carried forward was £53,602.

Profit after taxation of the wholly-owned subsidiary, the Zambesia Investment Co., the accounts of which are not consolidated with those of the parent company, amounted to £38,668 as compared with £24,043. No dividend was paid, thereby avoiding distributed profits tax, and the carry-forward was increased from £24,043 to £62,711.

TANGANYIKA HOLDINGS LTD.

The assets of Tanganyika Holdings, formed in September 1950, consist chiefly of the interests of Zambesia Exploring and Tanganyika Concessions in Rhodesia-Katanga, Uruwira Minerals, Geita Gold, and Kentan Areas. A profit of £2,927 after taxation was shown by this company last year, while its balance sheet showed investments at £152,059, having a market value of £175,381.

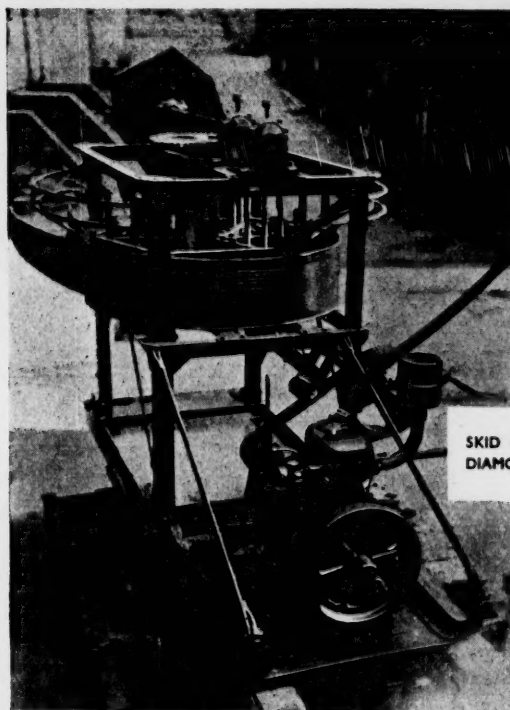
Following on the agreement reached at the end of 1951 for the further exploration of the Rhodesia-Katanga's Kansanshi copper mine in N.W. Rhodesia, a new company called the Kansanshi Copper Mining Co. has been formed with an authorized capital of £875,000 in £1 shares. A drilling programme was mapped out and operations started towards the middle of last year under the technical direction of the Anglo American Corporation.

The first progress reports emphasize that while the work is being vigorously pressed forward, there can be no assessment of the potential value of the property until the completion of the work to be carried out during the period of the option granted to the new company, expiring on December 31, 1955.

For the implementation of the Uruwira Minerals development programme, loans were obtained from the U.S. Government which have opened the way for the erection of a production mill capable of treating 1,000 tons of ore per day. The property is situated in the Mpanda area of Tanganyika and is scheduled to start full production of copper and lead in 1954. The loans will be repaid by way of deliveries of these metals and under the contract the company has granted to the U.S. Government an option to purchase up to 50 per cent of production in each of the ten years after repayment of the loan.

The prospects for Kentan Areas hinge on the Geita gold mine in which a 90 per cent interest is held. Geita is situated in Tanganyika and New Consolidated Gold Fields act as Technical Advisers. Ore reserves at June 30, 1952, were estimated at 1,912,785 tons at a grade of 3.7 dwt. per ton.

During the year to June 30, 1952, 2,358 ft. of development were accomplished and, of 925 ft. sampled, 55.9 per cent proved payable at an average value of 5.26 dwt. per ton. The mill dealt with 212,600 tons and an operating profit of £39,416 was shown. The mining area covers about 11½ sq. miles.



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Rhokana Corporation Ltd.

RHOKANA CORPORATION LTD. is not only one of the most important copper producers on the Northern Rhodesian Copperbelt but is also, in a restricted sense, a successful holding company.

It has large share interests in two neighbouring copperbelt producers, Mufulira Copper Mines Ltd. and Nchanga Consolidated Copper Mines Ltd., which are both established dividend payers, and a 50 per cent interest in the ordinary issued capital of Rhodesia Copper Refineries. This company was formed in 1947 to refine Rhokana's production and that of Nchanga Consolidated which owns the remaining 50 per cent of the capital. At present Rhodesia Copper Refineries is nearing the completion of its expansion programme, undertaken to deal with the increased production of its two joint owners, and it is expected that the plant extensions for producing Vertically Cast Copper will be completed in another month or so. This will enable the whole of the output from both Rhokana and Nchanga to be converted into electrolytic shapes of which a high proportion will be vertically cast in special high-quality shapes.

Rhokana announced in November last the formation of a new company to develop the Corporation's Konkola and Kirila Bomwe Special Grant areas which lie about 40 miles north-west of Nkana. These two areas will be known as the Bancroft Mines Ltd. Diamond drilling has already proved ore reserves of over 80,000,000 tons averaging 3.6 per cent copper and it is proposed to develop and equip the mine on a basis of a production of 4,000 s.tons of copper a month. The new company will benefit from the special taxation treatment now afforded new mines in Northern Rhodesia, the main feature of which is that all capital expenditure incurred for the first full five years of operations will be allowed as a charge against profits spread over those five years.

RESULT OF OPERATIONS

During the year to June 30, 1952, the Rhokana Corporation's copper output amounted to 82,764 l.tons, an increase of 8,585 l.tons over the previous year; of this total 56,910 tons were electrolytic and 25,854 blister. Copper sales were more than maintained and amounted to 83,025 l.tons as against 81,296 previously. Production from the smelter, though adversely affected by shortage of coal, set up a record.

The Electrolytic Cobalt Refinery started production of electrolytic metal in August 1952. Cobalt alloy production during the year to June 30, 1952, was 1,698 s.tons containing 645 s.tons of cobalt.

Revenue from metal sales once more advanced, this time to £18,937,620 against £16,123,556, due both to the larger sales turnover and the higher copper price. Operating profit increased to £10,074,080 against £9,047,908 for the previous year.

Dividend income from Mufulira and Nchanga Consolidated also increased, and earnings before tax rose to £12,116,457 compared with £10,483,687. Taxation absorbed £4,255,535 (£2,353,071), a Sales Equalization Reserve of £400,000 was created, and the sum of £1,800,000 was allocated to general reserve. For the third year in succession the dividend on the Ordinary stock was increased, the total payment of 225 per cent (200 per cent) absorbing with the preference dividend £5,687,488 (£3,750,003) leaving the unappropriated profits slightly reduced at £454,349 against £488,415 brought forward.

The company's balance sheet disclosed fixed assets at £16,790,763—an increase of £1,511,932 on the year. Current assets rose to £16,330,709 compared with £15,533,362, and after allowing for current liabilities and reserves for income tax, totalling £12,377,608, net liquid assets amounted to £3,953,101.

Of potential importance, perhaps, was the discovery of small tonnages of uranium bearing ore at the south end of the Mindola section of the company's mine. Further exploration to delimit this occurrence is in progress.

The coal supply position during the year under review continued to be unsatisfactory; for much of the time output from the company's smelter and power plant was restricted and on two occasions it was necessary to shut down certain sections of the plant. The burning of wood in place of coal continued on an even more extensive scale. The Copperbelt Power Interconnection Scheme is now in commission and the company's plant is linked with those of the other three copper companies.

MUFULIRA COPPER MINES LTD.

Rhokana's holding in Mufulira Copper Mines Ltd. was increased as a result of the capitalization of that company's reserves and now stands at £2,166,666 representing 26.59 per cent of its issued capital.

For the year to June 30, 1952, the company's production of blister copper amounted to 76,369 l.tons compared with 86,681 the previous year. On this output costs per ton, including smelting and administration were £89 9s. 3d. against £70 18s. 1d. Provision for replacements brought the total costs up to £102 11s. 1d. per ton against £82 8s. 10d. The tonnage of ore dealt with was 2,932,005 tons which compared with 3,355,143 tons. The net profit after tax for the year amounted to £2,617,816 compared with £2,764,795 the previous year. The total distribution for the year was 8s. 3d. per share.

During the current year it is hoped that production will reach about 85,000 l.tons provided that fuel supplies are adequate.

Mufulira presents an unusually active scene owing to the amount of construction taking place. In addition to the erection of a new refinery, the first stage of which is planned to produce 3,000 tons electrolytic copper per month, work is proceeding on other new projects. Preparations are being made for an extension to the mill and smelter; new offices have been built together with housing accommodation; the power stations are being enlarged; construction and development work has begun on the property of its subsidiary company Chibuluma Mines Ltd., and finally, work is being carried out in the Baluba Special Grant area.

After a period of long negotiations, H.M. Treasury has agreed to the removal of the company's domicile to Northern Rhodesia.

NCHANGA CONSOLIDATED COPPER MINES LTD.

Rhokana Corporation's holdings in Nchanga Consolidated remains unchanged at £2,355,000 Stock, representing 33.6 per cent of the issued capital. Results of the company's operations for the year to March 31, 1952, were most impressive and new records for production, sales and profits were established, although the mill throughput was nearly 25,000 tons lower at 1,512,900 tons. The output of finished copper rose from 54,550 tons to 68,816 tons and sales expanded from 51,074 to 79,500 tons. The explanation of the larger output from a smaller mill throughput was due to the improved grade of ore treated, 6.46 per cent copper per ton against 5.90 per cent per ton, and the higher percentage recovery achieved.

The total proceeds from sales of copper and concentrates were nearly doubled at a little over £16,100,000, while working profit at £10,060,000 rose in the same proportion. Profit before taxation increased by over £5,000,000. Taxation took a larger slice of profits, £3,727,000 against £1,865,000. The dividend was increased from 37½ per cent to 50 per cent and absorbed £3,500,000.

The company was the last of the big Rhodesian copper producers to come into production, and it is only now that the company is getting into its full stride. A large scale expansion programme designed to enable copper production to reach 108,000 tons per annum which was begun in 1947 was virtually completed during the year and will, it is expected, result in increased production during the current year.

So far a considerable part of the Capital Expenditure Programme has been financed out of profits and in view of the continued prosperity of the company, £2,000,000 was transferred to General Reserve out of profits during the year under review.

Technically the company's mines are in a first-class position, with total ore reserves amounting to 135,330,000 tons, with an average grade of 4.63 per cent.

COPPER PRICE AND LABOUR

The tendency towards a somewhat easier supply position in recent months has resulted in the Ministry allowing some Rhodesian copper to be sold on the continent and sales in the United States have further reflected the adequacy of the supplies in the United Kingdom. Labour relations with European employees were satisfactory during the year. There was, however, a deterioration in relationships with the African labour force towards the end of the year under review which manifested itself in a three week strike in October last.

Roan Antelope Copper Mines Ltd.

THE genesis of Roan Antelope goes back to the early days of the Northern Rhodesia copper field. The company was the pioneer venture and hopes entertained at the outset of operations have more than been fulfilled. The property in the Luangwa district consists of the Roan Antelope, Rietbok, Roan Antelope Extension and Muliashi mining locations. Extensive development work has been carried out and large ore reserves established. At June 30, 1952, when the company struck its balance, they were computed at 92,067,141 s.tons showing a substantial increase, and estimated to contain 3.19 per cent copper.

During the financial year, the output of blister copper amounted to 81,027 l.tons against 74,520 l.tons. Revenue from sales rose to £205 18s. 1d. against £176 3d. 7d. per l.ton, but the company had to report an increase in costs at £103 3s. 10d. as against £98 3s. 10d. the previous year. This was after allowing for replacements and obsolescence.

The total amount received for copper sales was £16,683,795. Mining, milling, smelting, etc., together with mineral royalty called for £7,060,331 and from the operating profit of £9,635,736 which was a record, taxation called for £5,888,767 as against £4,120,694 the previous year. The net profit came out at £2,642,914 compared with £1,796,672. The dividend amounted to 2s. 3d. per share; the 1950-51 payment, adjusted to allow for the capital bonus distributed during the year was 1s. 7½d. The increase fulfilled the most optimistic forecasts.

The company continued to sell its output of blister copper to the Ministry of Materials throughout the year.

Developments proceeded satisfactorily; a larger footage of the work was accomplished and the grade of ore sent to the mill showed a small increase. In accordance with the mining plan for balanced production throughout the whole ore body, a larger tonnage was drawn from Roan Extension. Diamond drilling was carried out in the Muliashi Special Grant area and work on a winze started.

Prospecting work was also carried out on properties of the four different companies in the Group, viz., Chisangwa Mines Ltd., Kadola Mines Ltd., Luapula Mines Ltd. and Mwinilunga Mines Ltd. In the first of these the Roan Antelope has a 30 per cent interest and in the other three a 45 per cent interest. Mufulira has the same percentage of interest in these four companies and the balance is held by the British South Africa Co. The work was undertaken, on behalf of the companies by Rhodesian Selection Trust (Service) Ltd.

The problem of coal supplies is still one that has not been solved, and full production is only maintained by continuing to burn wood as fuel.

Although deliveries of essential equipment delayed the Power Interconnection Scheme—a local grid system between the four copper companies—the first stage has been reached and the grid has been used.

There have been stoppages at the property on account of industrial disputes but all employees share in the prosperity of the industry through cash bonus schemes which are related to profits, and all enjoy cost-of-living allowances which vary according to an official price index.

After a long period of delay in connection with the company's application for the transfer of its domicile to Northern Rhodesia, H.M. Treasury gave its consent early in March of this year. The company had for a long time considered that events were moving towards a shift in the centre of political gravity for Northern Rhodesian affairs from the U.K. to Rhodesia, and now that permission has been given, full control can be exercised at the site of operations.

Mufulira Copper Mines Ltd.

THE expansion programme of Mufulira Copper, which has been proceeding for several years, made further progress last year. The company's output was not quite equal to the 1950-51 record owing to the set-back occasioned by the African labour strike.

This young and expanding mine, in which Rhodesian Selection Trust has over 60 per cent interest, presents a balanced picture; on the one hand it is continuing its expansion scheme, with the large capital expenditure which this involves, while on the other it is producing copper and building up reserves. The mine presents

an unusually active scene owing to the amount of construction which is taking place. It is erecting a new refinery, the first stage of which, planned to produce 3,000 tons electrolytic copper per month, has commenced and the second stage, which will double this figure, is scheduled to come into production some time in 1954 though some delay has been caused. When completed the refinery will be able to turn out various electrolytic shapes. Shipments of cathodes have already taken place.

The cost of the refinery, including copper locked up in it, is estimated at about £4,000,000, which is to be met from profits.

Simultaneously with the surface work and the new refinery, other new projects are in hand.

These include a large-scale programme for developing the mine below the 1650 level, consisting principally of the Peterson Incline Shafts, underground hoisting and crushing stations, an incline belt conveyor from the Peterson Shaft to No. 5 and Selkirk Shafts, and the equipment of No. 5 Shaft itself.

Fortunately, the company has been able to set aside large funds to meet the big expenditure involved in all this work. It is being financed either through the replacement reserve or the general reserve. Allocations out of profits to these reserve accounts have amounted to £7,750,000 over the last five years and they will continue to call for appropriations over the next few years of

approximately the same order. When it is all completed Mufulira will be one of the most modern and prominent copper producers on the Copperbelt. The company was formed about 23 years ago after drilling had indicated a large ore reserve on the property which lies within the Nkana Concessions in the Luangwa district of Northern Rhodesia. Production of copper commenced in 1933.

Sales of copper during the year to June 30, 1952, declined from 83,681 to 76,369, but were made at a higher average price. Because of the fall in sales tonnage, however, the expansion in operating profit was only moderate, the figure being £9,336,537 compared with £8,969,133. This advance was more than off-set by a rise in the taxation charge from £5,111,714 to £5,651,927, the net profit of £2,617,816 showing a slight setback from the

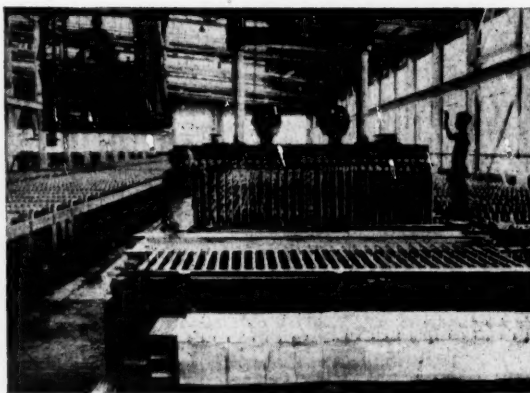
previous year's total of £2,764,795. The distribution to shareholders was unchanged at 8s. 3d. per share, which called for £1,764,578, which was a conservative handling of the year's profit. With the help of a tax recovery amounting to £655,000 the company was able to place £1,250,000 to general reserve in addition to repeating the allocation of £1,000,000 to replacements and obsolescence account before the net profit figure was struck.

In addition to its own property, the company has a wholly-owned subsidiary—the Chibuluma Co., which is being developed with a view to getting into production by 1956. It is also exploiting the Baluba Mines, a copper-cobalt property, discovered in 1929. This may entail large capital expenditure, and while no company has yet been formed, provision for the considerable finance necessary for this purpose is well advanced, and exploration to confirm the characteristics of the ore body has progressed.

Roan Antelope			Mufulira			
49/50	50/51	51/52	Output and Unit Costs	49/50	50/51	51/52
3,367	3,970	4,368	Tons milled (000 s.tons)	3,101	3,325	2,923
63.6	74.5	81.0	Blister prod'n. (000 l.tons)	77.0	86.7	76.4
127.2	176.2	205.9	Revenue per ton (£)	126.4	174.9	205.9
87.2	98.2	103.2	*Cost per ton (£)	64.1	82.4	102.6
40.0	78.0	102.7	*Profit per ton (£)	62.3	92.5	103.3
Financial Results			Financial Results			
(£000)			(£000)			
7,994	13,243	16,826	*Revenue	9,108	15,017	16,020
4,553	5,953	7,190	Operating cost	4,149	6,048	6,683
3,440	7,290	9,636	Surplus	4,959	8,969	9,337
27	36	111	Investment revenue	35	49	102
90	114	170	London expenses	76	97	137
900	1,250	1,000	Replacement reserve	700	1,000	1,000
45	45	45	Loan Stock Interest	32	32	32
+ 2	—	—	Misc. items (+ or —)	— 10	— 13	—
2,435	5,917	8,532	Profit before tax	4,177	7,876	8,270
1,615	4,121	5,889	Taxation	2,570	5,112	5,652
99	249	128	Reserves	486	1,096	631
687	1,546	2,123	Dividend	1,143	1,765	1,765
+ 34	+ 1	— 81	Carry forward (+ or —)	— 23	— 95	— 12

*Including production, selling and admin. costs and replacement reserves.
*After adjustment for increase or decrease in blister stocks.

*Including production, selling and admin. costs and replacement reserves.
†After adjustment for increase or decrease in blister stocks.



Removing cathodes at the refinery of Mufulira Copper Mines Ltd.

Selection Trust

THE announcement last month that Selection Trust had formed a Canadian subsidiary by Federal Charter to be known as Selco Exploration Co. serves as an apt reminder that the company long ago had associations with that country. When Selection Trust was registered in the United Kingdom in 1933 it acquired all the issued capital of Canadian Selection Co. which was then liquidated. This was an interesting transaction because three years earlier in 1930 the Canadian Selection Co. had acquired all the principal assets and business activities of the original Selection Trust which had been converted into a public company in 1925 from a private concern founded by Mr. A. Chester Beatty. The present issued capital is £2,242,399 represented by 4,484,797 Ordinary stock units of 10s. each.

Since the Trust was established, success has followed success and to-day it stands as one of the leading finance houses in the mining industry, with an extensive spread of assets. Its most outstanding achievement was its pioneering work carried out on the Northern Rhodesian Copperbelt, which resulted in the formation of Roan Antelope Copper Mines and Mufulira Copper Mines, though it should not be forgotten that the Trust brought to fruition as a first-class lead-zinc producer the important Trepsa Mines in Yugoslavia, since nationalized, and formed Consolidated African Selection Trust, the important West African diamond producer. More recently it participated in the re-financing of the very rich base metal producer, the Tsumeb mine in South-West Africa.

Seltrust Investments, in which Selection Trust holds all the issued ordinary capital and 20 per cent of the issued preference shares, is an important subsidiary. This company owns all the issued capital of African Selection Trust (Pty), which is incorporated in South Africa, and valuable interests in Tsumeb Corporation and Western Holdings but its principal assets are 648,270 shares of common stock in American Metal Co. and 1,900,000 stock units of Consolidated African Selection Trust.

The American Metal Co. carries on a base metal mining, smelting and marketing business, mainly through agencies. It has large interests in the Rhodesian copper producing industry, owning 32.65 per cent of the capital of Roan Antelope Copper Mines and 50.61 per cent of the capital of Rhodesian Selection Trust, whose principal holding is a 64 per cent share interest in Mufulira Copper Mines. It will be recalled that Treasury permission has recently been given for these Rhodesian Copper Companies to move their domicile from the United Kingdom to Northern Rhodesia. 30 per cent interest is also held in Tsumeb Corporation. The American Metal Co. is a large and prosperous undertaking and for the year ended December 31, 1952, showed a trading surplus of \$9,990,831 out of which dividends totalling \$1.50 per common share were paid, and a stock bonus of 5 per cent was distributed. In 1951 the surplus was \$10,782,359 and dividends of \$3 per common share (equivalent to \$1.50 on the capital as now split) were paid and a stock bonus of 5 per cent distributed.

INTEREST IN THE O.F.S.

Selection Trust was one of the first entrants into the Orange Free State goldfields and obtained options over mineral rights. It still retains its interests in farms north of the Sand River and through Union Corporation in certain blocks adjoining the property of Western Reefs. It has shareholdings in O.F.S. companies, the principal being St. Helena, which is now making steady progress, and Western Holdings.

In the field of exploration, Selection Trust has always been well to the fore. In Africa it is currently examining certain areas in the West Rand together with Johannesburg Consolidated Investment Co., and investigating a mining proposition in Southern Rhodesia. Elsewhere in the mining world it is actively investigating mineral possibilities in Canada for which purpose it has formed the Canadian subsidiary referred to in the opening paragraph. This company, whose head office is in Toronto, has a capital of 1,000,000 shares of no par value.

Selection Trust has an agreement with Trepsa Mines whereby Trepsa has the right to a 20 per cent participation in all new mining business undertaken by the Trust. On the other hand, Selection Trust is entitled to 10 per cent of the net annual profits of the company and has the right to subscribe for 1,000,000 Trepsa 5s. shares at par and a further 1,000,000 shares at 6s.

For the year to March 31, 1952, the gross revenue of Selection Trust and its subsidiaries amounted to £1,991,647 compared with £1,404,288. After meeting administration and other expenses the net revenue was £1,903,942 against £1,319,160. Taxation absorbed £1,007,085 while the year's dividend, increased from 32½ per cent to 45 per cent, required £529,767.

The consolidated balance sheet showed total investments of £2,820,251. An interim dividend has been paid in respect of the year to March 31, 1953, of 12½ per cent, the same as the interim dividend for the previous year.

Consolidated African Selection Trust

CONSOLIDATED AFRICAN SELECTION TRUST, or "Casts" to use its familiar market name, is by far the largest single producer of diamonds, both gem and industrial, in British West Africa. But even so, the course of the company's operations does not always proceed smoothly. The explanation perhaps lies in the structure of the West African diamond mining industry, for it is comprised of a very small number of well organised, heavily capitalised, tax-paying companies on the one hand, while on the other, there are a very large number of Africans operating either alone or in small groups who mine for diamonds wherever they can find them. Nor does it seem to matter to a large number of these Africans if that involves digging or panning in areas over which organised commercial concerns hold exclusive mining rights. This situation hits the big companies in two ways. It reduces the available labour supply and secondly, it necessitates building up and maintaining an efficient security system to prevent illicit mining operations.

This latter factor is particularly germane to "Casts" as its concession area in the Akim district of the Gold Coast covers nearly 70 square miles of thickly wooded country. And since the Africans have been permitted to take out diggers' licences on the very borders of the company's main operating zone, the difficulty of preventing illicit mining is obvious. Indeed, the depredations of the illicit miners in the last few years have been on the increase and were serious enough during the year to June 30, 1952, to lead the chairman of the company, Mr. C. W. Boise, to say in his annual statement accompanying the report and accounts for that year, that illicit diamond mining constituted a serious threat to the company's operations in the Gold Coast.

However, the Gold Coast Government is now fully alive to the existing situation and with the full co-operation of the Gold Coast police, the company has had some success in reducing illicit mining operations. In Sierra Leone, where the company's wholly owned subsidiary Sierra Leone Selection Trust operates, the twin problems of theft and illicit mining have recently become serious. As in the case of the Gold Coast, the company's security officials are working with the Sierra Leone Police and the situation is showing signs of improvement.

During the year to June 30, 1952, the demand for and sale of diamonds—both gem and industrial—was at record levels and it was therefore disappointing to find that the combined profit of "Casts" and its subsidiaries contracted by £504,625 to £2,192,797. How different, of course, the position might have been if theft and illicit mining operations had been prevented is not known.

Year to June 30	Working Profit £	Tax- ation £	Net Profit £	Divi- dend %	To Reserve £	Carry Forward £
1952	2,192,797	1,453,125	739,672	80	152,267	158,484
1951	2,697,422	1,716,786	980,636	100	484,093	118,032
1950	2,366,255	1,242,500	1,123,755	80	436,273	442,680

The explanation given by the chairman in his statement accompanying the accounts is that the profit decline was due to a sharp fall in both the quantity and value of the production of Sierra Leone Selection Trust. This resulted, Mr. Boise stated, in a reduction in net revenues of Sierra Leone Selection Trust, after deducting operating expenses, of about £670,000, that is, from £2,100,000 to £1,430,000.

Added to these difficulties, the tax man was hardly less demanding and the net profit figure was approximately £240,000 lower than in the previous year. This meant that though the dividend was maintained at 4s. the special bonus of 1s. which had been distributed in the previous year from tax savings was not repeated. The dividend payment required a net amount of £636,953. The allocation to reserves was somewhat lower and the carry-forward at the financial year end was some £40,000 stronger.

The consolidated balance sheet shows the company to be in a strong financial position. Total assets amounted to £8,366,459. Of this sum current assets accounted for £6,438,101 compared with current liabilities of £2,394,546. Net current assets, therefore, totalled £4,043,555, or £2,527,000 in excess of the issued capital of £1,516,555.

The outlook for the current year is good. There has been some relaxation of the high level of demand recently existing, both for gem and industrial stones. The whole of the company's production will however be absorbed under its selling contracts with the Diamond Corporation so that the results obtained should, at least, bear close scrutiny with those obtained during the year under review. However, E.P.L. has still to be reckoned with for this year, thereby making the tax burden even more onerous than the 66 per cent of the profits payable to the United Kingdom and Colonial exchequers in respect of the financial year under review.

Gold Coast Selection Trust Group

DURING 1952, the market for West African gold mining shares was again out of favour with the investing public. But perceptible stirrings were apparent in the first quarter of the current year due to a return of confidence rather than to any particular result or development emanating from the gold mines themselves although, as usual, there were several excellent results recorded. In fact, interest in this market may well have been more vigorous in 1952 but for the introduction of a dearer money policy in last year's budget. This resulted in higher yields being obtained on marketable securities and consequently gold mining share prices in general, drifted downwards.

Gold Coast Government policy also affected the gold mining industry. On the one hand, it changed the basis of computing the mineral duty payable which imposed a greater financial burden on the industry as a whole. Specifically, it assisted the low grade producers at the expense of the high grade mines. On the other hand, the Government authorized the mines to sell the whole of their gold output at premium prices instead of the 40 per cent previously allowed in October 1951. This concession was both valuable and timely; valuable because it gave the producers approximately 15s. more per f.oz. produced; timely because the companies were called upon to pay higher wages to their African labour force, which, together with the increase on costs of stores and materials, required substantial additional expenditure.

All these factors directly or indirectly affected the fortunes of Gold Coast Selection Trust which is the leading mining-finance house dealing with the West African gold mining industry.

GOLD COAST SELECTION TRUST

During the year to September 30, 1952, opportunities to increase the revenue of Gold Coast Selection Trust by share dealings were even rarer than in the unfavourable preceding year. As a consequence, income from this source amounted to a mere £2,357. A great deal of the resultant disappointment was eliminated by the welcome addition of £24,002 to dividend income from the trust's investments. Amalgamated Banket, for example, paid a dividend for the first time for fourteen years and Ankobra River Power paid a maiden dividend. Ariston Gold Mines and Gold Coast Main Reef also contributed to this success by making larger distributions. Two other shareholdings complete the main part of the trust's portfolio: Bremang Gold, whose dividend was unchanged, and Marlu Gold, which has been out of the dividend list since 1940-41—although it should not be much longer ere this company too will contribute to the trust's income.

Year to Sept. 30	Dividend Income	Sales of Investments	Tax	Net Profit	Dividend %	Retained
1952	110,630	2,357	9,187	83,517	12½	34,298
1951	86,628	19,449	10,753	87,983	12½	38,651
1950	113,373	28,514	31,774	102,492	14	71,555

During the year, the trust spread its interest a little more widely, and about 10 per cent of the portfolio is now held in interests outside the gold industry of the Gold Coast. These cover an extensive geographical area from Nigeria to South Africa and Rhodesia, and from Portugal to the United Kingdom. The economic spread is equally diversified, encompassing the production of gold, uranium, tin, columbite and wolfram. It also embraces various U.K. industrial companies.

The book value of the quoted investments in the balance sheet at September 30, 1952, was £1,150,269; having a market valuation at that date of £1,229,858. Some £51,380 was deducted from the

newly-formed investment reserve to adjust the book values of certain of the investments held. The trust's liquid position improved somewhat, net current assets at the end of 1951-52, having risen from £93,442 to £108,937.

MARLU GOLD MINING AREAS LTD.

From the report of the Marlu Co. for the year ended September 30, 1952, summarized in the table on the opposite page, it will be seen that Marlu Gold had a better time during the year to September 30, 1952, than in the previous financial year. An extra 6,240 tons of ore were put through the mill and, as this was of a slightly higher grade, the production of gold increased to 45,751 oz., against 42,547 oz. in 1950-51. The sale of the total output on the free gold market from May 1952, raised the revenue received from each ounce of gold and the result of the better price for a larger number of ounces was an increase in bullion revenue of £70,000 at £594,691. The net profit for the year was £48,011 as compared with £32,494 for 1951.

Approximately half the increase in bullion revenue per ton was offset by a rise in costs. An exact comparison of costs between the last two financial years, however, is not possible, because underground sulphide ore was being produced during part of 1951-52, whereas the whole of the 1950-51 output was from the oxidized zone at present being worked by mechanical shovels. During the year to September 30, 1952, the miners received an award of higher wages, following the publication of the Libbury Commission Report on Wage Demands, but the effects of this increase were reduced by a contraction in the labour force.

Capital expenditure made in the September 1952 quarter was only £2,313. Even this modest sum was slashed to £481 in the December 1952 quarter.

If the experience of 1951-52 could be repeated in the current financial year without the capital expenditure, a modest dividend could be paid on the £2,000,000 capital. And if the set-back suffered because of high rainfall in May and June 1952 can be avoided, the prospects of a resumption of dividends after thirteen years will be much brighter.

Higher working costs caused a revision of the reserves in 1951. At September 30, 1952, they were 1,092,000 tons of an average value of 2.68 dwt. per ton, of oxidized ore and 481,500 tons averaging 7.3 dwt. per ton in the sulphide zone.

In his review to members for the accounting year to September 30, 1952, the chairman stated that the operating profit for the first half of the current year is approximately £20,000 up on the corresponding period of the previous year and the prospect of a resumption of dividends is a great deal brighter.

AMALGAMATED BANKET AREAS

Undoubtedly the main event of the year to September 30, 1951 concerning Amalgamated Banket Areas was its return, welcome albeit expected, to the dividend list after an absence of fourteen years. The return was made in modest fashion with 2½ per cent for one year to September 30, 1951, but this was followed by the payment of 5 per cent for the year to September 30, 1952.

During the year to September 30 last, tonnage milled fell by 21,000 tons to 636,000 tons, but the grade of ore sent to the mill improved by 0.4 dwt. to 3.4 dwt. The effect of the improvement in the grade was greater than the decline in the tonnage crushed so that the quantity of gold recovered was more than 9,700 f.oz. higher at 103,523 f.oz. The bigger average premium received per oz. of gold produced on the larger output raised bullion revenue by £184,150 to £1,343,562.

OPERATING RESULTS FOR THE GROUP'S PRODUCING MINES IN WEST AFRICA

Company	Year Ended	Tons milled (000)	Grade (dwt.)	Yield (oz.)	Cost* per ton s. d.	Bullion† Revenue £	Other Income £	Mining Costs £	Other Expenses £	Gold Duty £	Tax £	Net Profit £	Dividend %	Carry Forward £
Marlu Gold Mining Areas	30/9/52 30/9/51	477 471	1.9 1.8	45,751 42,547	20 4 18 11	594,691 525,316	696 Nil	485,158 445,259	62,218 47,563	Nil Nil	Nil Nil	48,001 32,494	Nil Nil	57,425 5,503
Amalgamated Banket Areas	30/9/52 30/9/51	636 657	3.4 3.0	103,523 93,749	33 11 26 8	1,343,562 1,159,412	900 766	1,000,407 763,999	204,236 168,682	Nil Nil	Nil Nil	139,819 227,497	2½ —	196,559 202,867
Ariston Gold Mines	30/9/52 30/9/51	330 328	7.6 7.1	114,932†† 103,636‡	56 11 52 1	1,495,005 1,321,318	4,241 1,330	911,699 771,948	178,319 144,569	19,810 73,707	253,787 177,387	155,441 155,037	30 25	56,025 62,892
Gold Coast Main Reef	30/6/52 30/6/51	102 94	8.2 7.5	36,965 30,980	70 10 68 8	472,700 384,034	1,066 6,065	327,033 284,627	73,052 71,059	Nil Nil	Nil Nil	73,681 34,413	7½ 5	38,435 15,206
Bremang Gold Dredging	31/12/51 31/12/50	8,184‡ 8,707‡	2.6‡ 2.3‡	40,861 37,916	0 9** 0 8**	510,739 469,469	2,510 501	300,801 292,848	41,551 29,108	24,005 28,379	88,238 63,725	58,654 55,910	7½ 7½	41,964 24,819

*Including development charges.

†Less realization charges.

‡Excluding 3,186 oz. received from re-treatment of accumulated concentrates.

§Cu. yd. treated.

||Grains recovered per cu. yd.

**Cu. yd. treated.

††Including 456 oz. recovered from by-products.

Increases in African wages, costs of stores and materials and a higher proportion of underground ore to surface ore milled forced up production costs by £236,408 with the result that net profits were only £139,819 against £227,497. The payment of 5 per cent against 2½ per cent in spite of smaller profits appeared to be due to two factors: first an appropriation made after calculating net profits, and secondly, the conservative dividend policy in 1950-51. In that year expenditure pending the reopening of the Tamsoo and Fanti sections absorbed £113,106 which reduced the amount available for distribution to £114,391, but during the year under review the Tamsoo section had been reopened and only £70,287 was required leaving £69,532 available out of the year's profits for dividend payments.

When the Fanti section opens in June this drain should cease and instead of money flowing out the reopened section should contribute towards profits. This prospect offers the company a wider and brighter future, especially if it means that the disappointing returns announced in the poorer quarters of March and June of 1952, caused by heavy rainfall, can be avoided.

BREMANG GOLD DREDGING

Although the full story of Bremang Gold Dredging during the year to December 31, 1952, must await the publication of the report and accounts later in the year, the quarterly reports provide a sufficiently good guide to show that 1952 was slightly less successful than the very good results obtained in 1951.

The amount of ground treated fell by the substantial quantity of 1,150,000 cu. yd. to 7,034,100, due chiefly to the fact that No. 2 dredge stopped working in the early days of July for dismantling and subsequent re-erection on the new site on the Offin River. By the end of the year, all the superstructure had been removed from the Ankobra River and excellent progress had been made in the re-erection work, expected to be completed in the autumn of the current year. This new area on the Offin River is part of the alluvial river areas purchased from Gold Coast Selection Trust in 1951 for £91,650 in stock units and for a 4 per cent royalty on the gross value of the gold recovered. Repairs to No. 4 dredge kept it out of commission from the beginning of the financial year until March 10, and later this dredge was working its way through unpayable ground in the fourth quarter of the year.

The less favourable operating experience has, naturally, affected the financial results, and the operating surplus, subject to depreciation, London Office charges, taxation and gold and mineral duties, was £170,000 against £212,448. Not all this decline will fall on the company, for taxation took 60 per cent of net profits during 1951, and the tax liability therefore will be less on account of 1952.

The reduced throughput is expected to be temporary, for the Offin River area has large ore reserves. In the upper Offin, reserves at December 31, 1951 were estimated at 68,157,900 cu. yd. with an average grade of 2.74 grains per cu. yd., and in the other Offin/Jimi Areas there are some 117,000,000 cu. yd. with an average grade of 2.64 grains per cu. yd. The reserves in the Ankobra River area have been reduced to 28,795,800 cu. yd. with an average grade of 2.84 grains per cu. yd.

ARISTON GOLD MINES (1929) LTD.

The working story of Ariston Gold Mines during the year to September, 1952 is one of continued progress. The milling of 330,430 tons of ore was a record, having increased by 2,060 tons from the record set up in the previous year. An upturn in the grade of ore treated from 7.134 dwt. to 7.628 helped to establish a new high output level at 114,932 f.oz., as compared with 103,636 f.oz. in the previous year. Thanks to the receipt of gold premiums for the whole output since April, 1952, the price received for gold was the highest ever at £13 3s. 3d. per oz.

The first discordant note was the rise in mining costs alone from

45s. 11d. to 55s. 2d. This rise from 45s. 11d. to 55s. 2d. was due to higher native wages and costs of stores and materials and would have been higher still, but for the more efficient control of operations and stores. Despite this increase, working profits expanded from £550,700 to £587,547. But the tax collector took as much as £253,787 against £177,387, thereby reducing net profits, after other expenses had been paid, to £155,441 against £155,037. The great year of records had brought in a mere extra £414 in net profits—a sad commentary on how the present taxation system rewards greater production.

Nonetheless daunted by this discouraging situation the company is currently making efforts to do even better. During the year under review the percentage of gold recovered was lifted from 88.4 per cent to 91.21 per cent and efforts are being made to improve this rate still further. During the first current quarter of the company's financial year ending September 30, 1952, the immediate objective was almost reached, being only 1,000 tons short of the 90,000 tons, and working profits were better at £170,443. Another cheering feature of the December quarter's return is the comparative stability in working costs per ton. During the next twelve months the new 40,000 tons per month winder will be erected and the tonnage will be stepped up progressively to that new level.

At September 30, 1952, ore reserves were equal to over 3,000,000 tons with an average value of 6.72 dwt., an increase of about 300,000 tons over the previous year but a decrease in value by 0.17 dwt. The policy of limiting underground development is still being followed in order to concentrate on the north ore body. This is bringing favourable results, for the length of reef on the 24th level is double that on the 20th level. None of the ore below level 20 has been included in the ore reserves so that when this is eventually taken in, the reserves should receive another substantial boost.

GOLD COAST MAIN REEF

Gold Coast Main Reef mine is divided into three sections—the high grade ore bodies of the Tuappim workings to the south; Bondaye, the most fully developed section; and Ekotokroo which is relatively unexplored. Both Bondaye and Ekotokroo have a common boundary with Ariston and the three sections are on the same quartz reef as that company. In fact, their proximity and similarity of working conditions have led to close co-operation which has made possible the introduction of various economies ranging from central administration to joint management.

The year to June 30, 1952, can fairly be described as satisfactory, with improvements in a number of departments. After a three-year decline in the milled throughput, the tonnage treated swung up from 93,609 to 101,775 and, following the preceding year's improvement in grade, the head value of ore treated rose to 8.23 dwt., against 7.59. Working profits also increased, from £99,407 to £145,667, despite the higher wages being paid at the end of the financial year; and the ability of the company to sell the whole of its output on the free market, instead of 40 per cent as formerly, helped to swell profits.

Development still continues well. At Bondaye, an ore shoot has been proved on level 14 over a length of 365 ft. averaging 11.03 dwt. over 43.4in. On level 11 at Tuappim, the extension ore body was proved over 85 ft. averaging 10.06 dwt. over 53.9 in., and on level 21 it had increased to 165 ft. averaging 10.92 dwt. over 59.2 in. In the Ekotokroo section, values of 545 in.-dwt. were found over 240 ft. on level 3; 161 in.-dwt. over 85 ft. on level 8; and 318 in.-dwt. over 145 ft. on the 9th level.

During the current year results have continued encouraging—the amount milled in January 1953 was the highest for 3½ years—and two interim dividends have been paid amounting to 7½ per cent, equal to the dividends paid for the whole of the year to June 30, 1952. When the milling rate has been raised to 10,000 tons per month, the position will be reconsidered. The capacity of the plant is 15,000 tons per month.

SUMMARY OF OPERATIONS SINCE DATE OF LATEST PUBLISHED REPORT AND ACCOUNTS

Company	Period	Tons Milled (000)	Grade (dwt.)	Yield (oz.)	Bullion Revenue £	Mining Costs £	Working Profit £	Capital Expenditure £	Available Ore Reserves as at last Published Report‡		
									Tons (000)	Value (dwt.)	Width (in.)
Marlu	3 months to 31/12/52	123,206	1.9	11,917	158,918	123,280	35,658*	481	1,573.5	4.01	—
Amal. Banket	3 months to 31/12/52	173,621	3.2	27,441	365,478	273,003	92,475†	17,935	3,979.173	3.76	—
Ariston	3 months to 31/12/52	89,000	7.0	30,974	413,159	242,716	170,443†	17,171	2,764.3	6.88	147
G.C. Main Reef	6 months to 31/12/52	51,119	7.6	19,320	259,472	175,403*	84,069†	13,238	318.2	8.93	61.3

*Including development charges.

†Excluding development charges.

‡Latest published figures—see table on opposite page.

Ashanti Goldfields Corporation Ltd.

THE political trend in the immediate post war period, with its bias towards centralized power in the hands of the State, had its supporters in the Gold Coast. Dr. Kwame Nkrumah at the head of the C.P.P. Party swept into power in 1951, contemporaneously with the granting of a large measure of self-government to the Gold Coast. The stage was thus set for radical changes and many feared the extension of State authority to the gold mining industry.

In the circumstances, it was not unnatural that Ashanti Goldfields and its sister undertaking, Bibiani, in common with other West African gold producers, went out of favour with the investing public. In fact, the "wait and see" attitude adopted by the investor resulted in a steady downward trend in the share value of "West Africans," and Ashanti Goldfields, the richest mine in the world for its size, sank to its lowest level for many a year. Bibiani followed suit.

Indeed, the general belief was that unless and until political horizons were brighter and, as a corollary, labour relations easier, no amount of excellent results would shift the market away from its artificially depressed price levels towards a more realistic evaluation of the mines' real worth.

The obvious need, then, was for a declaration of intentions in order to clear the air of the uncertainties and misconceptions which so easily arise during periods following major political changes.

NEED FOR EUROPEAN & AFRICAN CO-OPERATION

Comment, apposite and provocative, on the general situation was made by General Spears at the annual meeting of Ashanti and Bibiani in May 1952. The keynote of his speech was that European and African co-operation was essential for the steady and peaceful progress of the Gold Coast towards political maturity and the development of a prosperous economy. His real fear was that the African, projected as he was into a wholly novel political situation would be tempted to go too far too fast. At the same time he was not unaware that indications were becoming more numerous that the Gold Coast Government was settling down to its appointed task with a greater sense of responsibility than was at one time thought possible.

Government spokesmen were quick to respond. At the close of last year Mr. Gbedemah, Minister of Commerce and Industry, showed that the Gold Coast Government fully realized the importance to the country's continued prosperity of maintaining a healthy and active mining industry. The Government had no intention he said, of nationalizing the gold mines and it clearly recognized the harm such a policy would do if it was believed that it was ready to pounce on businesses that had been built up by private enterprise.

By that time the substance of Mr. Gbedemah's declaration was, of course, well understood by all those in touch with Gold Coast affairs. Nevertheless, the Minister's enunciation was necessary if only to kill any remaining doubts on this score. More than that, confidence in the Gold Coast to conduct its affairs with an open mind and a level head was exemplified by the participation of powerful interests from Canada, and the United Kingdom in the giant Volta River Project.

The turning point in the fortunes of West African gold producers and their return from the wilderness to which they had been banished by the investor on purely political grounds was reflected in the revival of market activity at the beginning of 1953—a revival in which Ashanti was well to the fore.

Certainly, the results announced by Ashanti for the year ended September 30, 1952, were not calculated to effect this change earlier.

Development work carried out during the year failed to produce any outstanding results apart from consistently good reef values exposed on level 27. Moreover, a series of unofficial strikes, the most serious of which occurred in July last and continued for 12 days, put an end to the corporation's hopes of producing 180,000 oz. of gold during the year. As can be seen from the table below, gold production declined by 22,426 oz. reflecting the lower tonnage throughput and the drop in the grade of ore sent to the

mill. Working costs, mainly due to the increase in African wages, rose sharply from 57s. 11d. to 70s. 9d. and as a result, mining costs, spread over a slightly smaller tonnage, were nearly £115,000 higher at £967,586. Tax attracted was lighter even though the year's total liabilities included £30,000 for E.P.L. The dividend was maintained at 50 per cent, after taking a further £25,000 for fixed assets replacement and £14,218 for pensions, although to do so meant drawing on the balance brought forward for the sum of £59,772, of which £29,573 was accounted for by African gratuities in respect of earlier years.

Yet when it is considered that the Corporation is undertaking a weighty programme of capital expenditure and development involving the employment of a perceptible percentage of its available factors of production the results obtained must be considered satisfactory.

SHAFT SINKING AND DEVELOPMENT

The shaft sinking and development programme in which the Corporation is now engaged dominates the whole of its activities.

Essentially, it involves the sinking of two main shafts, a sub-vertical shaft, and development work on level 35—the deepest level of the mine—and in the upper section of the mine above and below level 12.

The two main shafts concerned in the shaft sinking programme are the South shaft and the Eaton Turner shaft. The Eaton Turner shaft is the more important of the two as it will, when completed, serve the reef in the north end of the mine at its deepest levels. The sinking of this shaft has made excellent progress and by the end of April last was down to 800 ft. in good ground. By this date the South shaft had reached level 32—its final depth—and preparations for hoisting from this level were well advanced and it was expected that this shaft would be operating from a skip pocket below that level by the end of the current financial year. Additionally, the sub-vertical shaft reached level 38 in February of this year and crosscutting to the reef at this depth has been started.

It was from this sub-vertical shaft that in December last a drive northward in crosscut No. 16 to level 35 gave the company its first indication that the north ore body continued at that depth. The reef exposed was 8 ft. wide and assayed 44 dwt. per ton. Since the beginning of the year two more crosscuts have been driven on this level with very encouraging results. Crosscut No. 17 assayed 53 dwt. over 15 ft. with a stronger make of quartz, and No. 18 crosscut showed values of 44 dwt. over a width of 17 ft., the reef being stronger than on level 33.

Although ore from this level cannot be sent to the mill until the Eaton Turner shaft has been sunk to its final depth, which will be approximately 4,000 ft., the quality of these disclosures forcefully indicates that the mine is opening up extremely well in depth. The tonnage that can be won from this level on present indications, may not be sufficiently large to affect materially the overall grade of the Corporation's ore reserves. But taken in conjunction with the large tonnages proved on level 12, the grade of ore reserves might very well be adjusted upwards from their already high level of 18.8 dwt. per ton, when these two levels are fully within the compass of normal working operations.

Developments on level 12 first came into prominence in December last when it was announced that a south-west crosscut exposed the Obuasi reef over a width of no less than 57 ft. having an average assay value of 46.8 dwt. per ton. Even by Ashanti's own exceptional standards this was something quite remarkable. Further crosscuts put out during the March quarter of this year proved the reef on this level over a width of 250 ft. at an average width of 44 ft., with values of 7.5 dwt. per ton. At the south end of the drive values were exposed over more than 300 ft. and over a width of 40 ft. they averaged 10.5 dwt. In both these cases the lateral development was incomplete, and at the time of going to press no information was available as to how the values extended below level 12. But on level 10, which is being driven from Ayeim to cover these areas, values averaging 10.7 dwt. over a width of 15 ft. were exposed, in a crosscut directly above this zone. While further testing above and below level 12 has still to be carried out,

OPERATING RESULTS

Year to Sept. 30	s.tons milled (000)	Grade (dwt.)	Yield (oz.)	Cost* per ton s. d.	Bullion† Proceeds £	Other Income £	Mining Costs £	Other‡ Costs £	Taxation§ £	Free Balance £	Dividend %	Pension Fund £	To Reserve £	Ore Reserves	
														Tons (000)	Grade (dwt.)
1952	226.9	16.2	185,913	70 9	2,165,843	32,348	967,586	175,713	718,127	336,765	50	14,218	34,772	1,410.4	18.8
1951	237.6	17.2	188,339	57 11	2,359,642	42,245	852,857	165,816	1,003,412	379,802	50	13,654	38,402	1,506.9	18.4
1950	218.6	19.0	189,815	59 7	2,297,148	37,655	792,778	149,304	729,046	663,675	62½	13,000	192,639	1,616.4	18.5

*Excluding development charges.

†Less realization charges.

‡Depreciation and general expenses.

§Including Gold Coast Government royalty and gold duty.

||Taken from reserve.

all signs point to a considerable tonnage of mineable ore being made available.

It is, then, quite obvious even from the brief outline given above featuring only the more important and spectacular parts of the Corporation's heavy capital expenditure and development programme—that large inroads must have been made on the company's liquid resources. To meet this strain, the Corporation, during the year to September 30 last, reduced its holdings in British Government and Corporation Securities by £150,916. In view of the commitments in the years immediately ahead the whole of its investments of this type have been put into short-dated securities, redeemable not later than 1957. A further assistance to the Corporation's policy to maintain a high degree of liquidity over the next few years arises from its ability to run down its stocks of consumable stores which had been deliberately built up and which at the end of the last financial year stood at the high figure of £642,239.

OUTLOOK FOR THE CURRENT YEAR

The heavy capital expenditure programme will, of course demand that resources be carefully husbanded, but there is no reason to suppose that the Corporation will not maintain its dividend distribution at its present level. The position at the mine is satisfactory and output is steadily increasing. In the month of

April 23,500 tons were milled and the target figure of 25,000 tons per month is in sight. It is hoped to sink the Eaton Turner shaft down to a depth of between 1,800 and 2,000 ft. during the current year enabling the permanent winding gear, much of which is already on the property, to be brought into use.

The financial side of the picture will also be brighter. The reduction in the standard rate of income tax will mean a saving of some £20,000, and the reintroduction of the capital expenditure allowance will result in an immediate saving in taxation of some £40,000—£50,000 a year. This is, of course, only a temporary saving since the ultimate tax liability is only postponed until a later date. Should, however, income tax be further reduced by the time this tax falls due to be paid the Corporation will stand to benefit. On the basis of the Corporation's 1953 profits, the abolition of E.P.L. will help the Corporation to the extent of some £70,000 to £75,000 a year.

During the first seven months of the current year estimated profits, subject to taxation, amounted to approximately £537,800 compared with £527,500 in the corresponding period of the year under review, an increase of some £10,000. Thus if the premium on free gold sales is maintained at around £1 per oz., as in the year under review, the report and accounts covering the current year's operations should make interesting reading.

Bibiani (1927) Ltd.

ONCE more the report and accounts of Bibiani (1927) Ltd. for the year ended September 30, 1952, gave the impression that everything was under control and operations were proceeding according to plan.

The grade of ore treated at 4.4 dwt. per ton represented a slight drop from the previous year's figures of 4.6 dwt. per ton. This was largely offset by the increased tonnage throughput which established a new high record, but gold production was down by some 3,000 oz. compared with the preceding year.

Bullion proceeds actually amounted to £933,191 compared with £925,707 but owing to the greater costs of selling the gold on the free market, bullion realization charges rose from £3,538 to £11,349 so that net proceeds came out at a lower figure than in 1951. Tax liabilities decreased owing to the fall in profits and also, in the case of profits tax, because of the change in the methods of charging introduced by the 1952 Finance Act. No liability is expected for Excess Profits Levy.

Major-General Sir Edward L. Spears, chairman, in his statement accompanying the accounts said that the Board regretted the need to reduce the dividend but the results for the year reflecting as they did higher mining costs and the company's financial position after meeting the essential needs for equipment and development* made the distribution of 17½ per cent the maximum that could be recommended.

GOOD PROGRESS UNDERGROUND

Of particular importance has been the success attending the company's efforts to improve the underground stoping position so that a greater tonnage can be mined from underground sources which will give an increased gold production. In this connection the chairman said that progress since the end of the company's financial year had been good and that from February onwards it was expected that a monthly gold output of 6,250 oz. would be maintained. This figure was, in fact, surpassed in March when the total yield was 6,276 oz., and equalled in April when 6,250 oz. was obtained from the crushing of 30,000 s.tons.

Development footage again showed an increase, this time from 28,300 ft. to 30,781 ft. Of this footage, very good results were obtained on level 18 where as much as 80,000 tons of 8.35 dwt. ore were proven and taken into the ore reserves. Work on the Internal shaft on this level has, however, been the company's main preoccupation. This work is well in hand and it has been possible to winze to level 19 immediately below values exposed on level 18. In the first crosscut completed, ore averaging 9.5 dwt. was proved over a width of 26 ft. The development of this area has been an important feature of work done in recent years and priority is being given to completing the connection between the South and Central

shafts and to the preparation for sinking the Internal shaft which will operate below this level.

An interesting development has been the discovery of a large block of ore, 450 ft. in length, extending upwards to level 12 and containing 280,000 tons of ore. This ore is being prepared for bulk mining and the encouraging progress made towards establishing an efficient technique suggests that the system might be utilized in the future when favourable conditions present themselves.

Level 10, where at the close of the year new ore was reported at the north end of the mine over a length of 260 ft., has been continued, and a total length of 450 ft. of ore averaging 6.3 dwt. per ton and 14.5 ft. wide had been proved by February of this year. The continuation of this ore body is now being sought on level 11 and if necessary below that.

These shaft sinking and development operations have exerted a strain on the company's resources and it is the declared intention of the company to concentrate on building up its reserves. Just how much of a strain these operations have proved to be may be judged by the fact that the company realized its holdings of British Government securities to meet the heavy expenditure necessary. Cash balances at the year end stood at £33,154 compared with £146,247 at the end of the previous accounting period. On the other hand, stores and plant were recorded in the balance sheet at the high figure of £436,679 and since the end of the financial year it has been decided to reduce these holdings to more normal levels which will result in an improvement in the cash position. Net current assets at September 30 last stood at £297,201.

FUTURE DEVELOPMENT

During the current year development work will be concentrated on lateral development between levels 9 and 15. This represents a break from previous work priorities which for the last five years has been concentrated on the extension of the South ore body from level 13 to level 19. This has involved shaft and other service extensions requiring considerable capital expenditure. Thus, if development work laterally should prove to be successful it would postpone the need for deepening the mine and, in the short term, enable resources to be allocated for other urgent needs. The shaft sinking programme for the current year is to sink the Central shaft to level 20, complete skip hoisting arrangements from just below level 19 and to continue with the Internal shaft.

For the first seven months of the current year gold production totalled 42,946 oz. for a profit, subject to taxation of approximately £87,300 which compares with an output of 42,152 oz. and a profit of approximately £112,000 in the corresponding period of the year under review.

OPERATING RESULTS

Year to Sept. 30	s.tons milled (000)	Grade (dwt.)	Yield (oz.)	Cost* per ton s. d.	Bullion† Proceeds £	Other Income £	Mining Costs £	Other Costs £	Taxation‡ £	Free Balance £	Dividend %	Staff Assurance Fund £	To Reserves £	Ore Reserves	
														Tons (000)	Grade (dwt.)
1952	363.3	4.4	71,440	37 8	921,842	4,666	685,192	81,329	52,050	107,937	17.5	8,180	42,170	1,766.2	5.4
1951	352.6	4.6	74,868	35 6	922,169	5,018	625,755	79,320	110,639	111,473	20‡	8,975	47,810	1,764.4	5.4
1950	33.4	4.8	73,996	32 7	922,311	4,057‡	559,083	72,101	141,311	177,373	25	7,401	90,497	1,759.8	5.3

*Including development charges. †Less realization charges. ‡Including gold duty paid to the Gold Coast Government.
§Excluding £23,500 received on insurance claim.

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Aluminium Ltd.

THE year 1952 was one of peak output and unprecedented expansion for the aluminium industry as a whole. New and reactivated smelters in several parts of the world resulted in a total production larger than any previous year. On a volumetric basis aluminium in 1952 for the first time exceeded the combined production of the older non-ferrous metals, copper, zinc, and lead.

Aluminium Ltd.'s production and sale of aluminium products in 1952 reached \$333,000,000, compared to \$284,000,000 in 1951. This is the highest sales volume in the company's history. During 1952 operating companies of the Aluminium Ltd. Group made important progress in the expansion of their mining activities in several parts of the world. The first alumina to be extracted in the Caribbean area was produced in December by Alumina Jamaica Ltd., in a new plant which uses bauxite mined on the island.

Aluminium Ltd. has several of its expansion programmes going forward in the sterling area. These investments are making an important contribution to the development of a higher level of industry in colonial areas, as well as facilitating trade among members of the sterling block. Such developments as the further modernization of mining equipment in British Guiana, and the expenditure of over £13,000,000 on the new alumina plant in Jamaica, cannot help but have an important effect on the health of Commonwealth industry.

The Aluminium Ltd. Group of Companies is composed of enterprises controlled by Aluminium Ltd. by virtue of its ownership of a majority of their voting stock or otherwise. From a corporate standpoint the company is solely a holding company which owns or controls 47 concerns incorporated in 20 different countries of the world. In keeping with its character as a holding company, Aluminium Ltd. itself does not engage in any mining, manufacturing or sales activities. The companies of the Aluminium Ltd. organization fall into two broad categories: service or management units which perform a variety of staff functions for the Group, and operating companies which function in the fields of mining, transportation, power, aluminium production, and fabrication.

Among the most important operating companies are those concerned with the procurement of raw materials. The principal raw materials required for the production of aluminium are bauxite, cryolite, fluorspar, petroleum, coke, and electricity. Of these, bauxite and electricity are the two basic ingredients, and Aluminium Ltd. has companies which concern themselves with the production of each of these requirements.

BAUXITE

Since aluminium is the most abundant metallic element, forming about 8 per cent of the solid portion of the earth's crust, aluminous ores are found in nearly all parts of the world. But ores of commercial quality (that is, containing about 50 per cent aluminium oxide) are called bauxite and are found only in tropical and semi-tropical areas. Although the smelters at Arvida, Canada, alone are using up bauxite at the rate of 2,000,000 tonnes a year, the company's reserves of the ore are believed to be sufficient to meet expanding requirements for some time to come. Proven sources in British Guiana, for example, are expected to be adequate for the Quebec smelters for thirty years.

MINING DEVELOPMENTS IN 1952

The company's most important single item of progress in the mining field in 1952 was the completion of a new alumina plant in Jamaica. Alumina Jamaica Ltd., a wholly-owned subsidiary of Aluminium Ltd., has constructed a bauxite and alumina plant designed to reach an annual capacity of 165,000 tonnes of processed alumina by April, 1954. The primary purpose of the plant is to provide alumina for the new aluminium smelting facilities now under construction at Kitimat, British Columbia on Canada's north-west coast. Shipments of alumina will be made through the Panama Canal for Kitimat when it begins operations in 1954.

Construction of the alumina plant and other operations by the company is costing some £13,600,000. This includes the creation of a deep water seaport at Old Harbor Bay on the south coast of Jamaica, and extensive agricultural projects. The establishment of this plant means increased revenue for the colony and the employment of more Jamaicans both in the new industry and mining and in subsidiary services growing up as a result of the plant's needs.

The Kirkvine Alumina Plant utilizes for the first time one of the large reserves of bauxite in the world. Aluminium Ltd. were pioneers in the development of Jamaica's ore reserves, having analysed the first samples of bauxite as far back as 1942. The first major shipment of bauxite was made in 1943 when a trainload was shipped for large scale experimentation in Canada.

The complicated maze of machinery and equipment which comprises the alumina plant ranges from steel tanks 80 ft. high with a capacity of up to 500,000 gallons, to rotary calcining kilns 220 ft. in length. In the process, which was specially developed for Jamaican ore by the company's engineers, the reddish clay-like bauxite is transformed into alumina, a white granular powder of one-third the bulk. Much of the steel used in erecting the plant was purchased in the United Kingdom. To obtain the large quantities of water required for operation of the plant two wells were sunk 300 ft. below sea level at Trinity near Porus. The water is pumped through a vertical elevation of about 1,000 ft. to a million-gallon reservoir on a hill near the plant. The feedline is four miles long and nearly a foot in diameter.

To handle shipping, a modern 600-ft. steel and concrete pier 88 ft. wide is being built at Old Harbor Bay, some 35 miles from the alumina plant. To obtain the required 32 ft. of water alongside the dock and a turning basin and channel, nearly 3,000,000 cu. yd. of sand and clay were dredged from the harbour.

A new method of shipping alumina will be put into operation by the company in order to handle the large quantities to be produced by the expanded plant. The alumina will be discharged directly into the ship's hold in bulk instead of being loaded in bags. This technique, never before attempted on this scale with alumina, will speed up loading time to a rate of 600 tons per hour and will result in considerable economies in time and effort both at the shipping point and at the destination. Saguenay Terminals Ltd., an associate company of Alumina Jamaica Ltd. and Canada's largest shipping company, has ordered a deep-sea vessel specially designed to carry alumina. This ship, of 12,400 tons deadweight, is being built in a Canadian shipbuilding yard at Lauzon, Quebec.

DEVELOPMENT OF FURTHER BAUXITE DEPOSITS

In 1952 the company's bauxite mines in British Guiana in South America continued to be the main source of supply for the Canadian smelters. The Demerara Bauxite Co., a subsidiary of Aluminium Ltd., has open pit mines near Mackenzie, 62 miles up the Demerara River from Georgetown, the capital of British Guiana. The company now employs 2,500 people operating a plant for crushing, washing, drying and calcining the bauxite. During the year additional capacity for drying and calcining the ore was installed. In addition, new and improved mining equipment was purchased.

During the year a French subsidiary of Aluminium Ltd. was responsible for bringing into production the largest bauxite development yet undertaken on the African continent. This new bauxite mining and processing installation is on the Los Islands, off the coast of French West Africa. First shipments of treated bauxite were made to the Canadian smelters in September 1952, and shipments during this year are expected to reach 300,000 tonnes. The ore is obtained by the usual method of open-pit mining in which power shovels load heavy diesel trucks which carry the ore from mine to beneficiation plant. At the plant the crushed ore is washed to remove some of the silica and then dried in a rotary kiln some 180 ft. long by 9 ft. wide. This removes excess water, making the ore ready for shipment. A modern loading dock, complete with a conveyor system, is now in operation.

ALUMINIUM LTD'S EXPANSION PROGRAMME

The above developments in the mining and ore-processing field were a relatively small part of the expansion programme of Aluminium Ltd. in 1952. The programme, begun in 1950, is scheduled to be completed in 1954 at a total cost of \$435,000,000. Some \$306,000,000 had already been spent at the end of 1952. The major items in this expansion programme are being built by the Aluminum Co. of Canada Ltd., the largest operating subsidiary of Aluminium Ltd. These are two new hydro-electric developments on the Peribonka River in northern Quebec, and a vast new power-aluminium complex on Canada's west coast. The hydro-electric installations in Quebec, which were substantially completed in 1952, will supply enough additional power to permit the production of nearly 500,000 tonnes of aluminium in the company's four smelters in the Province of Quebec.

The second and larger part of the expansion programme comprises a great new hydro-electric plant at Kemano, British Columbia, and the construction of an aluminium smelter and related materials handling facilities at Kitimat, about 50 miles distant. The water-storage reservoir for the hydro-electric plant is now complete, and gradually filling. Generating capacity of the first stage of this project is to be 450,000 horsepower, and smelters with an annual capacity of 83,000 tonnes are expected to be producing ingot by the middle of 1954. This expansion programme reflects Aluminium Ltd's firm faith in the bright future of aluminium, whose constantly expanding use is based on a unique combination of valuable physical properties.



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5in.	x	4in.	x	20	"	"
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100	"	x 100	" 25 "
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125	"	x 125	" 31 "



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British Guiana Consolidated Goldfields Ltd.

Directors:

J. ROLAND ROBINSON, M.P. (Chairman) W. BALLENY, C.A., MAJOR C. J. BROOMAN-WHITE, C.B.E.,
H. A. COCHRAN, O.B.E., B.Sc., M.I.M.M., J. W. PARK, A.C.S.M., M.I.M.M., A.M.I.M.E.

THE company was incorporated as a Public Company in 1936 for the purpose of acquiring mining rights and conducting dredging operations over alluvial gold mining areas in British Guiana, particularly in the valleys of the Mahdia, Potaro and Konawaruk Rivers.

As a result of prospecting work in these and other areas, the company's rights now extend over 36,000 acres in which the total yardage of dredgeable ground so far proved and partially proved, totals 56,000,000 cu. yd. of an average value of 3.59 grains bullion.

The total issued share capital of the company amounts to £294,628 of which 30 per cent is held by the Colonial Development Corporation, who have provided further finance by way of secured loans of £405,371. The Corporation has also agreed to lend an additional £272,742 to complete the financing of the company's programme of development for dredging the Konawaruk area.

TWO DREDGES WORKING

The company has two dredges in operation:

- (1) a 5 cu. ft. Lobnitz dredge on the Mahdia River which has been in the main centre of the company's dredging activities since 1937. This dredge, which has to date dredged over 14,000,000 cu. yd. will complete the working of the Mahdia area by about the end of 1954.
- (2) a 6 cu. ft. Yuba dredge on the Lower Potaro River which started operating in August, 1951, and had recovered 21,450 f.oz. during the period to December 31, 1952, from 1,700,000 cu. yd.

The company has purchased a second-hand 10½ cu. ft. Yuba dredge to work the deposits in the Konawaruk area. This dredge has now reached British Guiana, but it is not anticipated that it will be in operation till 1955.

Apart from the areas referred to above, the company has prospecting rights in the valleys of the Mowassie and Siparuni rivers which will be investigated when the present prospecting programme in the Potaro and Konawaruk areas is completed.

RESULTS FOR 1952

The results for the year ended December 31, 1952, show a revenue of £237,294 earned from the two dredges working through ground which has yielded an average of 5.27 grains gold per cu. yd., and dredging in total a yardage of 1,688,955.

After providing for depreciation and amortization amounting to £45,693 and loan interest £11,052 the profit for the year, subject to taxation, was £56,574.

After providing for taxation and bringing in the carry forward from last year, including the tax provided of £7,000 no longer required, the total amount available was £38,381. After transferring £11,000 to General Reserve and paying a dividend of 8 per cent for the year, absorbing £12,964 net, a balance of £14,417 has been carried forward.

For the three months ended March 31, 1953, yardage dredged on the Mahdia and Potaro rivers totalled 574,200 cu. yd. yielding 3,081 f.oz.

During 1952 further progress has been made with providing additional facilities for the company's local employees in the interior where they are necessarily isolated from the amenities of town life. Apart from recreational facilities, hospital accommodation on the company's main camp has been substantially increased and improved, and fully qualified medical assistance made available. A scheme for the establishment of a Colonial Staff Provident Fund has been introduced.

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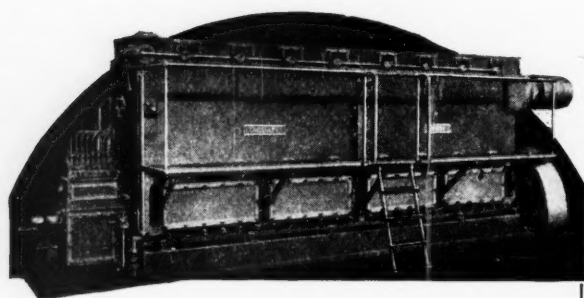
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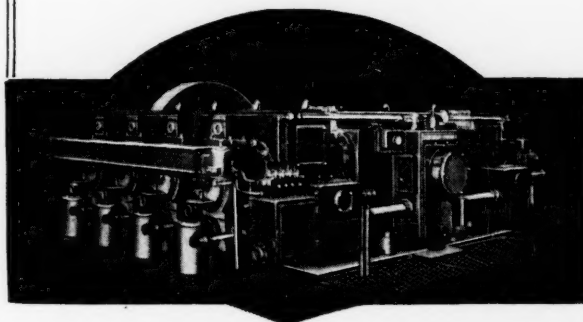
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Anglo-French Exploration Co. Ltd.

"STEADY progress" is the phrase which most aptly describes the career of the Anglo-French Exploration Co. which is now entering on its 64th year of life, having been formed in 1889. Its record, if not spectacular, is a model of consistency. During the last 20 years it has maintained an unbroken record of dividend payments; 10 per cent being paid in each of the six years 1933-1938; 5 per cent being paid during each of the six years 1939-1944; and finally, 7½ per cent being paid in each of the last eight years, 1945-1952. During this time its ordinary issued capital has been increased from £500,000 to £800,000 in units of £1 each at which figure it now stands.

The company's basic blueprint for its success is a widely based, carefully selected investment portfolio encompassing gold mines, tin producers, base metal mines and oilfields. A broad classification of these holdings expressed as a percentage of their valuation at the end of its last two financial years is shown in the following table:

Year to Dec. 31	Gold*	Oil	Copper†	Tin	Coal	Miscellaneous
	%	%	%	%	%	%
1952	61.7	12.0	9.7	9.8	6.5	0.3
1951	59.0	12.3	10.4	10.3	7.8	0.2

*Including holding companies which have substantial interests in gold mining companies.

†Refers to holdings in copper, lead and zinc.

The major proportion of its total holdings in gold mining companies is in mines along the West Wits Line, viz., West Driefontein, Doornfontein, Libanon and Venterspost. West Driefontein has come to be regarded as the richest mine in South Africa; Doornfontein, whose western boundary adjoins that of Blyvooruitzicht holds good promise of being a high-grade mine; Venterspost is forging ahead rapidly and Libanon has joined the ranks of the regular dividend distributors.

The company's interest in the Orange Free State goldfield has grown every year and now comprises Free State Geduld, Lorraine Gold, New Consolidated, Free State, Exploration, Orange Free State Investment Trust, Welkom, Western Holdings, Wit Extensions, and Harmony gold mines which was brought into its portfolio during 1952. Other holdings in gold mining companies as at December 31, 1952, were Consolidated Goldfields of South

Africa, Durban Roodepoort Deep, Luipaards Vlei Estates and Gold Mining, Vlakfontein Gold Mining, West Witwatersrand Areas, and Harrietteville (Tronoh) the Australian gold dredging company. Five of these gold mining companies, Free State Geduld, Harmony, Luipaards Vlei, Welkom, and Western Holdings are scheduled as uranium producers.

The prosperity enjoyed by the Northern Rhodesian copper producers comes to the company via its direct possession of shares in Nchanga Consolidated Copper Mines, and indirectly, through its investments in Rhodesian Selection Trust and Rhodesian Anglo American. To this strong copper contingent, Messina (Transvaal) Development Co. was added during 1952.

Its carefully chosen holdings in Malayan tin companies include Ayer Hitam, Sungai Besi, Sungai Way Dredging, and Malayan Tin Dredging all of which are in the Tronoh Malayan Tin group; Pengkalen in the Redruth Malayan Tin group; and finally, Petaling Tin, the independent and important Malayan incorporated tin producer. Additional holdings of tin producers outside Malaya include Anglo-Burma Tin, and Rooiberg Minerals.

The remainder of the company's investments give it a stake in the oil industry through its holdings in Apex (Trinidad) Oilfields and in Ultramar. The coal industry in South Africa is encompassed by its holding in the Transvaal producer, Apex Mines, while its investment in Mount Isa Mines gives it an interest in the Australian copper-lead-zinc industry.

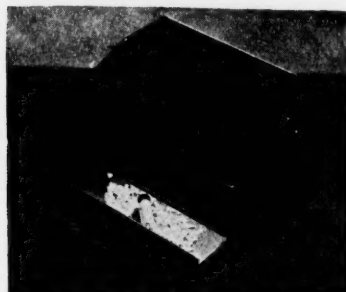
At December 31, 1952, the book cost of the company's investments stood in the balance sheet at £988,072 (£962,018). Of this total £944,127 (£922,242) represented quoted securities at or below cost having a market valuation of £1,148,028 (£1,196,682) and the remainder, £43,945 (£39,776) represented the book cost of its unquoted investments, the directors valuation being identical.

The profit and loss account for the year ended December 31, 1952, showed that total income amounted to £95,685 (£107,742) of which dividend income and interest-gross-accounted for £75,828. General expenses were less, £16,646 against £18,137, as were taxation liabilities which contracted to £47,101 compared with £55,772. Net profit was £31,938 compared with £33,833. The dividend of 7½ per cent required a net £31,500 leaving the carry forward a trifle higher at £29,548 against £29,110 brought in.

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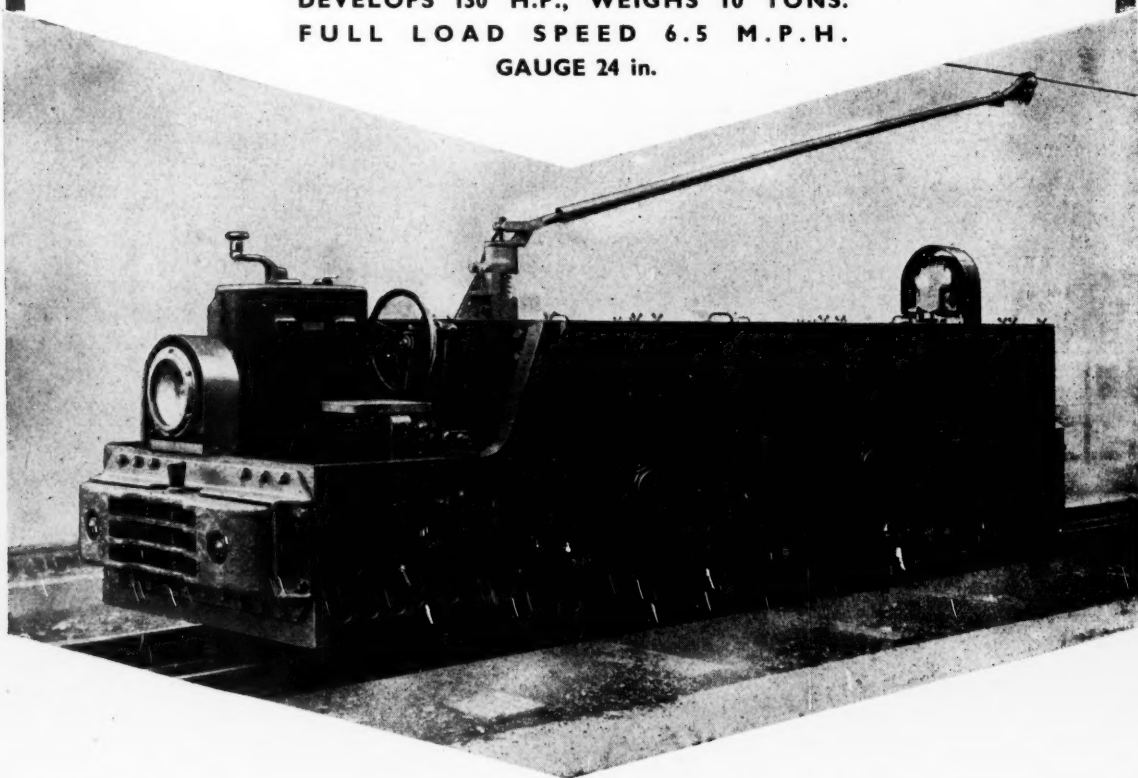
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North Kalgurli (1912) Ltd.

IN 1928 the then chairman of North Kalgurli (1912) said that the history of the company had yet to be written and despite the passage of 25 years this commentary remains true to-day. Indeed, after a thorough investigation into the size and shape of developments still to be translated into reality it will be at least another quarter of a century before a beginning can be made on this interesting story.

Relevant background material about the company is that it is situated on the north-western line of reefs of the famous Golden Mile in the East Coolgardie Goldfields, Western Australia and positioned between Paringa Mining and Exploration Co. on the north; South Kalgurli Consolidated and Kalgoorlie Enterprise on the south; and Gold Mines of Kalgoorlie (Aust.), Lake View & Star, Boulder Perseverance and Great Boulder Proprietary on the east. Until 1949 the company was bounded on the west by leases owned by North Kalgurli United Development Co. which separated the company's Croesus group of leases from the Kalgurli group. Their acquisition, however, provided the company with a continuity of working leases throughout the whole of its property. The United Development Co.'s group of leases are not at present being worked and represent future development plans. In this same category is the development of the company's Oroya North Block of leases which cuts into the middle of the mining leases held by Gold Mines of Kalgoorlie (Aust.).

Five shafts have been sunk on the company's property, the Kalgurli, North Kalgurli, Croesus Proprietary, Union Jack and the new Main Shaft, which was commissioned on July 30, 1952. Although the company has, excluding the leases comprising North Kalgurli United and the Oroya North Block, seven main lease areas, Croesus Proprietary, Union Jack, Genevieve, North Kalgurli, Birthday and Birthday South and Brookman's Boulder, only five are being developed, operations on the Union Jack and Croesus lease having been suspended.

THE MAIN SHAFT

Up to July 30 last, the Kalgurli and North Kalgurli shafts handled the tonnage dealt with from the five leases. The company's Main Shaft, which is sited about 100 ft. south-east of the North Kalgurli shaft, which it replaces, is in the approximate centre of gravity of the company's large ore reserves.

The completion of this shaft means a great deal to the company, for it provides the means whereby tonnage milled can be raised from its present level of around 18,000-20,000 tons per month up to as much as 30,000 tons per month, by providing hoisting facilities down to 1,632 ft., which covers the whole of the present estimated ore reserves—about 2,000,000 tons—in the company's Southern Group of leases.

More than that, the new shaft enables the company to plan, for the first time, an overall development programme encompassing the whole of its mining leases. Roughly speaking, future operations plan to deal with opening up the main lode below No. 8 level in the North Kalgurli lease area which will clear the way to large bodies of ore hitherto inaccessible. Development results already obtained show that the North Kalgurli East Lodes are opening up well as they go down. The latest information received is that driving on level 10 in sections G.2 and 3 has exposed an ore body 180 ft. long, averaging 16.8 dwt. which will be known as the "Tyrell" lode.

DEVELOPMENT WORK AHEAD

In the Kalgurli section ore bodies exposed by diamond drilling will be developed and an endeavour made to locate the downward extension of the N.E.D. lode. Furthermore, the Oroya Block North will be subjected to an intensive diamond drilling programme. Should this prove satisfactory it is planned to move the headgear from the North Kalgurli shaft to the existing Pomeroy Shaft in this lease originally belonging to the old Oroya Links Co. Ltd., to link-up with one of the main haulageways, and to hoist the ore through the new Main Shaft. While this is obviously a project, the implementation of which will require several years, it does not begin to exhaust the expansion schemes already in mind. Looking further into the future work will be concentrated on developing and opening up the very large area represented by the former United Leases and the Croesus Proprietary Mine. But before much in the way of actual work can begin on these projects further treatment facilities will have to be made available. In this connection the chairman, Mr. C. T. Ley, at the last annual meeting of the company held in London on October 1, last, said that during the current year he was going to visit the property chiefly for the purpose of discussing the availability of further treatment capacity.

The present arrangement is that the tonnage ore won from North Kalgurli and Kalgurli leases are treated partly in a treatment plant owned by Kalgurli Ore Treatment Co., the capital of which is owned as to one-third by North Kalgurli (1912) and the remainder by Boulder Perseverance, and partly at a plant belonging to Croesus Pty. Treatment Co. Ltd., the capital of which is jointly held by North Kalgurli (1912) and South Kalgurli Consolidated.

Mining operations at North Kalgurli during the year to January 1, 1952, were continuous and were confined to the southern group of leases.

Year*	Milled (tons)	Grade (dwt.)	Yield (oz.)	Develop- ment (ft.)	Ore Reserves† (tons)	(dwt.)
1951	251,743	5.0	58,928	8,206	2,183,162	5.62½
1950	244,066	5.2	59,063	8,588	2,314,941	5.53
1949	232,393	5.8	62,264	9,245	2,359,498	5.62

*Actually periods covered are to January 3, 1952; January 2, 1951; and January 1, 1950.

†Figures given relate to average of positive and probable tonnage and their estimated values per ton.

The total tonnage hoisted of 251,743 tons was distributed fairly evenly between the North Kalgurli shaft, 128,428 tons, and the Kalgurli shaft, 123,315 tons, and similarly the treatment quotas at each of the Kalgurli Ore Treatment company's plant and the Croesus Proprietary Treatment Co.'s plant were fully supplied. Despite the fact that over 7,000 tons more were treated during the year the grade was a trifle lower and total gold production figured at slightly less than in the preceding year.

Year	Ore Proceeds £	Mining Costs £	Taxation £	Net Profit £	Divi- dend %	Carry Forward £
1951	739,799	625,923	48,882	46,707	62½	50,737
1950	734,035	519,026	113,200	89,081	100	42,403
1949	645,253	434,703	112,050	87,744	112½	38,523

Yet ore proceeds were up by some £5,000 compared with 1950, but mining costs advanced by no less than £106,897—a sum not far short of the issued capital of £110,000. This was due chiefly to higher wages, increased maintenance and material charges. Although tax liabilities were heavily reduced—partly because of the tax relief on initial depreciation allowance of £15,605—net profit was reduced by nearly half that obtained in the preceding year. Accordingly, shareholders' dividend income was cut from 2s. to 1s. 3d. per 2s. share, which required a net amount of £36,094. The carry forward at the financial year-end at £50,737 showed an increase of £8,334 compared with the amount brought in.

That the total footage advanced during the last two years has been declining reflects the concentration of operations on the Main Shaft. Ore reserves also show a small contraction but even so present supplies are sufficient for nearly nine years at a crushing rate of 250,000 tons per annum.

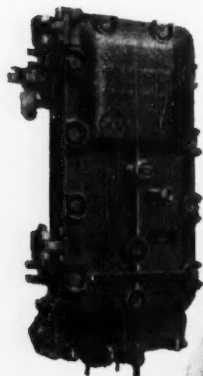
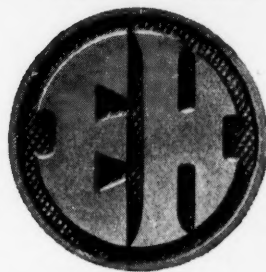
THE OUTLOOK

While the outlook for the company in the long run must be viewed as extremely promising, the prospect for the current year ended December 30, 1952, is more difficult to assess. Operating statistics, certainly, will show an improvement on those of the year under review, for provisional figures obtained from monthly output returns disclosed that gold production rose to 60,375 oz. compared with 58,928 oz. But it is difficult to know how the company will be affected by rising costs of labour and materials. During the year under review, basic wage rates rose every quarter, the increase being from £A.8 14s. 8d. per week paid in January 2, 1951, to a basic weekly rate of £A.10 10s. 11d. at October 22, 1951. During the first seven months of 1952 there were three more increases in the basic wage rate and at the beginning of January, 1953 it stood at £A.11 11s. 0d. per week. However, as can be readily computed from these figures the rise in the basic wage has been on a diminishing scale throughout 1952, and for the first time since 1947 the basic wage rate for the country's six capital cities was left unchanged when reviewed at the end of the March quarter 1953.

To set against a higher wages bill the company will have the benefit of selling its gold output on the free market for the full year instead of as from only three months as was the case during the year under review. Moreover, the labour situation at the mine, in common with other companies along the Golden Mile, should show an improvement and finally, the new Main Shaft should make for more economical mining.

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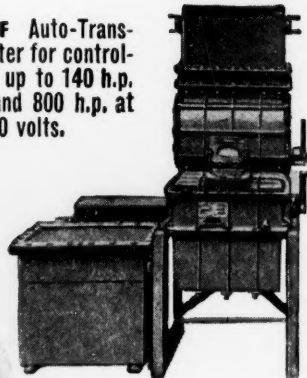
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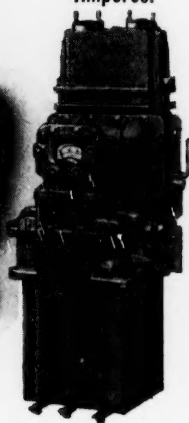
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Boulder Perseverance Ltd.

BOULDER PERSEVERANCE LTD. owns and operates the Perseverance gold-mining lease at Kalgoorlie, Western Australia. Although this lease covers 24 acres only, it has proved to be one of the richest gold-producing areas of its size in the world. Registered in 1923 to take over the assets of Great Boulder Perseverance Gold Mining Co. Ltd. (in liquidation), Boulder Perseverance owns 67.7 per cent of the capital of the Kalgurli Ore Treatment Co. Ltd., a non-profit earning co-operative treatment plant, with a capacity of approximately 1,000 l.tons per 24 hours. It also owns 65.2 per cent of the issued Share Capital of the Australian registered company, Kalgoorlie Enterprise Mines Ltd., which operates the Enterprise leases closely adjacent to the Perseverance lease.

Year to Mar. 31	Treated (tons)	Grade (dwt.)	Cost* per s.ton s. d.	Bullion Revenue £	Ore Reserves Tons	Grade (dwt.)
1952	132,387	4.95	46 7	397,844	334,550	4.9
1951	114,810	4.90	42 2	332,852†	387,400	4.8

*Including treatment costs.

†Including net receipts of £1,715 from re-treatment of tailings.

During the year ended March 31, 1952, Boulder Perseverance dealt with a larger tonnage than in the preceding year, whilst maintaining the grade of ore sent to the mill. But as can be seen from the table below, costs continued to rise with the result that after meeting all charges, including taxation, net profit was nearly £8,000 less than in the previous year. In the circumstances the distribution was lowered to 7½ per cent, £5,000 was transferred to general reserve, leaving the carry forward at the fiscal year end approximately the same as in the preceding year.

Year to Mar. 31	Gross Revenue £	Mine Costs £	Tax £	Net Profit £	Divi- dend %	Carry Forward £
1952	399,432	337,085	24,324	13,793	7½	6,778
1951	340,267	263,433	30,450	21,659	10	6,838

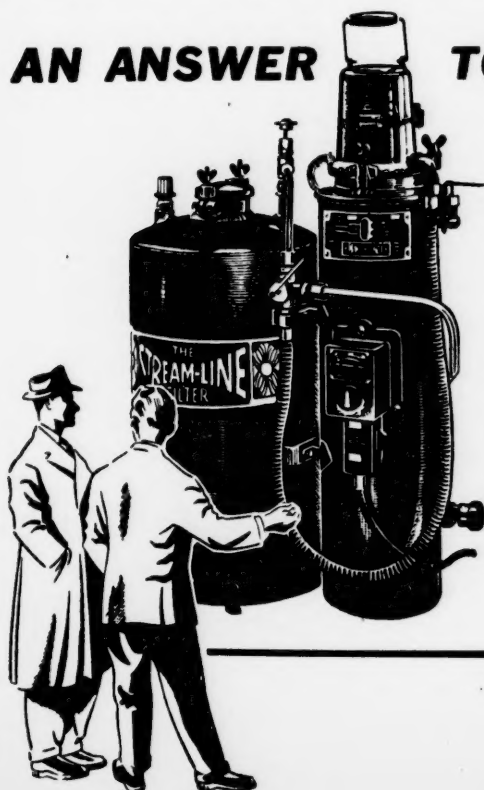
The Kalgurli Ore Treatment Co. Ltd. continued to operate at a very high level of efficiency during the year to March 31, 1952, and treated 342,126 l.tons of sulphide ore obtaining a computed extraction rate of 94.59 on Mint return. But owing to the increased costs of stores, power and wages, treatment costs rose from 19s.9.23d. (Aust.) to 22s. 7.96d. per ton. The company's other operating subsidiary Kalgoorlie Enterprise Mines, treated 56,644 tons of ore averaging 6.19 dwt., an increase of 10,600 tons with a reduction

of 0.47 dwt. as compared with the previous year. Ore reserves showed an increase of 6,600 tons to 231,400 with an unchanged grade of 6.3 dwt. Owing to the necessity for increased development the Board of Kalgoorlie Enterprise considered it desirable to conserve their cash resources and not to declare a dividend. The company paid a dividend of 4 per cent in the preceding year.

Dr. K. B. Edwards, chairman of Boulder Perseverance, in his statement accompanying this year's report and accounts said that facts and figures could not convey in full the fight the company has waged under steadily worsening conditions brought about by the unchecked inflation in Australia, nor the very high degree of technical skill which has been attained and developed in all operations. The inflationary situation, he declared, has produced a state of affairs which is progressively more and more unsound. In particular the policy of favouring the development of secondary industries in preference to the primary industry can only lead to disaster, as indeed it has done wherever it has been tried in countries without a large consuming public and ample natural resources.

Concerning the continuance of a restricted and artificial price for gold, the chairman cleared the air of any illusions which shareholders might harbour concerning the important question of how free is the "free market." Quite categorically, Dr. Edwards declared that the term "free" is completely mis-applied and deceptive, as a proportion of the gold produced is retained by the Commonwealth Bank of Australia and the remainder may only be sold for U.S. dollars, at a price based on the extraordinary fiction that the U.S. dollar is still worth its pre-war value. Furthermore, the proceeds in U.S. dollars must be credited to the Commonwealth Bank from whence the mining companies are paid in Australian currency. Nor are the companies allowed to sell their gold for Australian or any other currency in an open or free market. He also reminds stockholders that the purchasing and holding of gold by private individuals or corporations is still a penal offence throughout the British Commonwealth.

Concerning British taxation the chairman was no less forthright. It would be incredible, he states, were it not unfortunately true, that to pay a 10 per cent dividend, no less than 67 per cent of the company's profits are taken in taxation. Such iniquitous taxation, he asserts, would render any industrial venture or project extremely doubtful, but in the mining industry such taxation is fantastic folly.



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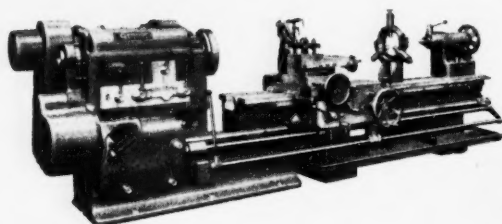
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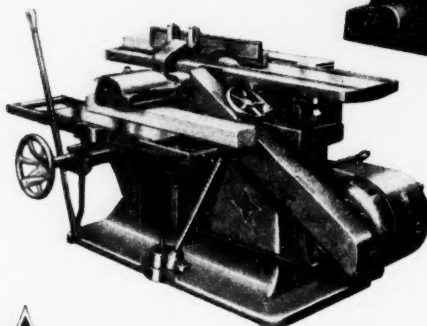
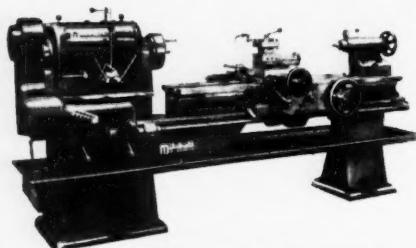
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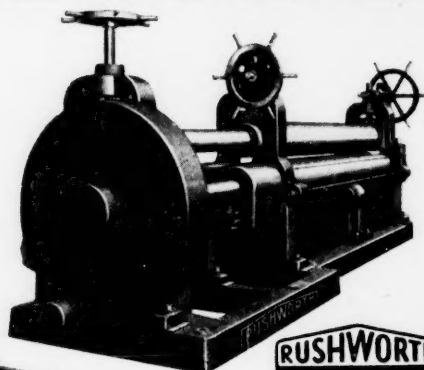
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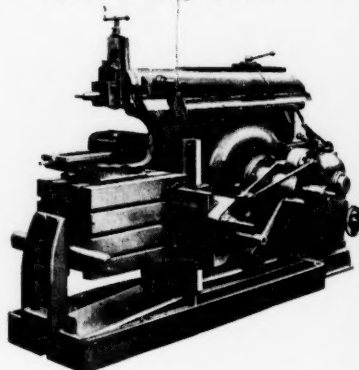
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SONS OF GWALIA, in common with other Westralian gold producers, suffered from an acute shortage of labour in 1951. Inflation, attracting as it habitually does labour away from primary and extractive industries to secondary industry in populated centres was the chief reason—accentuated in the case of this company by its mine being situated in a rather out of the way place.

Nevertheless, in spite of the manpower shortage, Sons of Gwalia from January to May, 1951, was operating at a rate equivalent to an annual mill throughput of 94,200 tons. But during the first week of May the crankshaft of the main winder broke, stopping all underground operations. A spare crankshaft on the property was installed and underground operations resumed 17 days after the breakdown. Yet during those 17 days the miners started to drift away and by the end of the month the number of men underground had dwindled to 95, the lowest complement since the war. Although it was hoped to make good the loss entailed, a solution to the labour problem remained intractable so that, in fact, the extent of the disorganization caused extended beyond the period of repair and it was not possible to make up the loss in the second half of the year.

Year to	Milled	Grade	Yield	Per Ton	Ore Reserves
Dec. 31	(tons)	(dwt.)	(oz.)	s. d.	(tons) (dwt.)
1951	82,572	4.6	19,186	59.4	591,136 5.46
1950	101,112	5.1	25,628	48.10	593,530 5.54

*Including development charges: 1952—2s. 10d. (1951—2s. 8d.).

This situation was fully reflected in the operating results achieved during the calendar year 1951 and shown above.

Tonnage of ore treated dropped by 18,540 tons to 82,572 tons and gold output by 6,442 oz. to 19,186 oz. compared with the preceding year. Costs rose by roughly 10s. 6d. per ton, indicative in part of the lower tonnage milled but largely to the continued rise in wages and industrial allowance which amounted to as much as £1 16s. 3d. per week during the year. On the other hand, ore reserves, both as to tonnage and value, were maintained.

Because of labour shortage, development work was confined largely to routine drilling of known lodes. While this enabled total footage advanced at 1,569 ft. to approximate to the total footage

advanced in 1950 amounting to 1,548 ft., diamond drilling had to be curtailed, only 2,287 ft. being drilled compared with 6,106 ft. in the previous year.

Since the scheme permitting the sale of 40 per cent of the company's gold output on the free market did not become effective until November 1951, there were no mitigating factors to blunt the full impact of the lower tonnage crushed and gold recovered. This is clearly demonstrated in the profit and loss account, the salient features of which are given in the following table.

Year to	Gold	Mining	Taxation	Net	Divi-	Carry
Dec. 31	Proceeds	Costs		Profit	dend	Forward
	£	£	£	£	%	£
1951	241,039	235,772	Nil	L 7,054	Nil	16,089
1950	318,750	242,804	35,000	27,653	20	26,786

Proceeds from the sale of gold contracted by £81,351 to £241,039. Mining costs, all points considered, were held down remarkably well and though there were no tax liabilities, a loss on the year's operations resulted. This loss was met out of the amount brought forward from 1950 which was also required to meet a charge of £3,643 for writing off investments.

While confirmation must await the appearance of the report and accounts for 1952, all signs point to the company having experienced a much better year.

Tangible signs are not wanting that the inflationary spiral in Australia has been checked; the labour supply position has improved considerably—though it is still not entirely satisfactory; a substantial amount of additional revenue will accrue to the company from its premium gold sales; and mechanization underground is being speeded up by the installation of scraper loaders. Moreover, provisional operating figures for 1952 show a big improvement and tonnage crushed totalled 95,494 tons yielding 23,767 oz., an increase of 12,922 tons and 4,581 oz. over the period under review.

At the last annual meeting held in London on August 26, 1951, the chairman, Captain Moreing, gave the cheerful news that the labour force had improved to 138 men underground, which figure, he hoped would be maintained and possibly increased.

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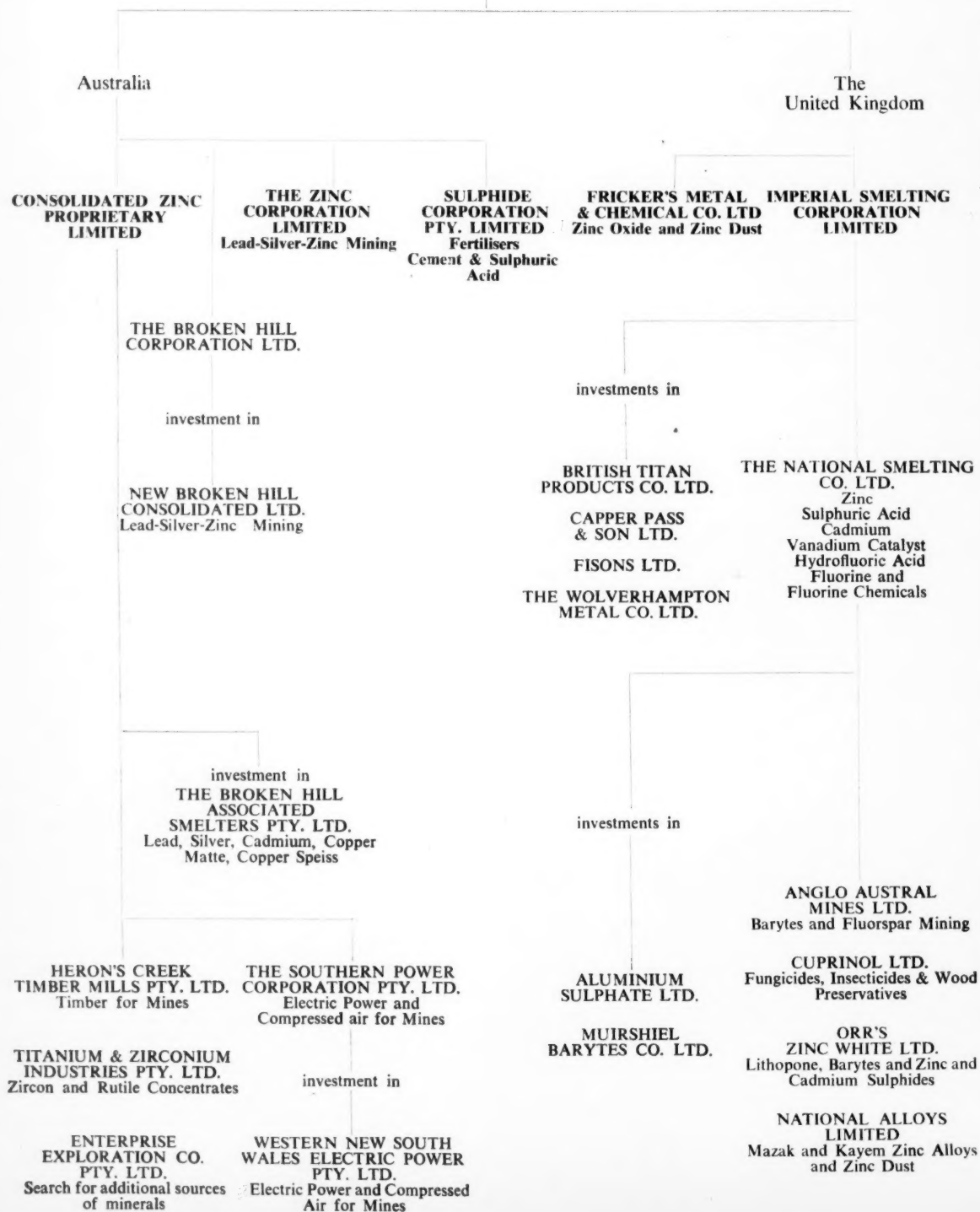


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THE CONSOLIDATED ZINC CORPORATION LIMITED



The Consolidated Zinc Corporation Ltd.

THE principal activities of The Consolidated Zinc Corporation Ltd. through its subsidiaries and associated companies are the mining of lead-silver-zinc ore in the Broken Hill district of New South Wales, Australia, the production of market lead and refined silver at the Port Pirie smelter in South Australia, and of zinc metal, sulphuric acid and ancillary products at various works in the United Kingdom.

During the past year an additional small subsidiary company has been established in Canada—The Consolidated Zinc Corporation of Canada Ltd. This company maintains contact with the mineral developments in Canada which are of likely interest to the parent company; in addition it is representing Imperial Smelting Corporation Ltd. for the marketing of certain of its products in Canada.

THE ZINC CORPORATION LTD.

During the course of the year The Zinc Corporation made considerable additions to mechanical equipment used underground in order to facilitate handling and transport. In addition, the intensive campaign to lower the accident rate resulted in a marked reduction of time lost on account of accidents, both on the surface as well as underground.

There has been an increase in labour force for the mines largely as a result of a widened area of residential qualification for membership of the Workers' Industrial Union of Australia. The labour force at the end of 1951 was 2,434 men as compared with 2,263 at the end of the previous year.

The underground developments have progressed satisfactorily. The blocked out ore reserves amounted to 5,200,000 tons of lead lode, an increase of 100,000 tons with a grade of 15.4 per cent lead, 3.1 oz. silver and 10.8 per cent zinc, and 500,000 tons of zinc lode with a grade of 6.8 per cent lead, 1.4 oz. silver and 16.8 per cent zinc.

The year's production of lead and zinc concentrates for The Zinc Corporation's account compared with 1951 is set out below:—

	1952	1951
Ore milled tons	449,282	440,302
Lead concentrates produced tons.....	77,214	80,789
Containing:		
Recoverable lead tons.....	56,583	58,982
Silver ounces	1,329,293	1,283,819
Zinc concentrates produced tons.....	87,353	88,872
Grade per cent zinc	52.6	52.4

NEW BROKEN HILL CONSOLIDATED LTD.

The most important development in 1951 was the further opening of the lead lode ore deposits at the horizon of No. 19 level. The results from this work were highly satisfactory. During the year a start was made in the stoping of ore from this source resulting in 3,000 tons of ore being stoped before the end of the period, averaging 17.2 per cent lead, 5.1 oz. silver and 11.3 per cent zinc. In addition the preparatory foot-wall openings and shaft connections for the three levels below No. 19 were advanced in accordance with the normal programme of mine development.

Massive lower grade zinc ore deposits which have been outlined by diamond drilling in the region of the haulage shaft appear to offer an excellent opportunity for large scale extraction by the relatively cheaper method of open sub-level stoping. The adoption of this method, though a considerable departure from standard practice hitherto employed in the Broken Hill field, however indicates every justification to hope that the experiment will be a success.

During 1951 increasing use was made of the haulage shaft for disposal of mullock from development and from stripping of the service shaft. At the end of the year 325 men were being lowered and hoisted daily at this shaft.

Despite delays in the delivery of certain items of equipment and difficulties in obtaining supplies of steel, much of the new surface plant has been completed. The haulage of ore and milling operations were commenced in September, 1952. The new concentrating mill is capable of handling 350,000 tons of ore per annum and is designed for expansion as production increases.

The year's production of lead and zinc concentrates compared with 1951 is set out below:—

	1952	1951
Ore milled tons	235,478	211,608
Lead concentrates produced tons.....	25,284	22,883
Containing:		
Recoverable lead tons.....	18,430	16,706
Silver ounces	405,801	386,617
Zinc concentrates produced tons.....	51,838	46,231
Grade per cent zinc	52.4	52.4

OTHER INTERESTS OF THE CONSOLIDATED ZINC CORPORATION LTD. IN AUSTRALIA

The Southern Power Corporation Pty. Ltd., of which the Group owns all the issued capital, has erected at Broken Hill an extensive new power station consisting of five electric generating sets, each of 2,370 kW. and three motor-driven air compressors. This company has satisfactorily supplied the additional electric power and compressed air requirements of The Zinc Corporation and New Broken Hill Consolidated Ltd.

In addition, the Group owns a 32 per cent interest in the Western New South Wales Electric Power Pty. Ltd., which prior to the formation of the Southern Power Corporation supplied the whole of the electricity and compressed air requirements of the Broken Hill field.

Although considerable damage was caused by bush fires to the various forest areas in New South Wales during the year, owing to the vigilance and efforts of the company's employees, little damage was caused to the property of Heron's Creek Timber Mills Pty. Ltd. This company supplies a major proportion of the mine timber requirements of The Zinc Corporation and New Broken Hill.

Titanium and Zirconium Industries Pty. Ltd. operates by developing the beach sand areas of Stradbroke Island, containing zircon, rutile and ilmenite. Extensions to the pilot plant to double the capacity for separating zircon and rutile have been completed. Of these products, the majority of the zircon produced has been exported to the U.S.A. and most of the rutile to U.K. and Continental consumers.

Amongst the other interests of the Group in Australia is included Enterprise Exploration Co. Pty. Ltd., which provides the geological, geophysical and other exploration services required by The Zinc Corporation and New Broken Hill Consolidated in their operations at Broken Hill and for the search for new sources of raw materials throughout the Commonwealth. In addition it also provides similar services, by contract, to third parties. Prospects in various areas of the Commonwealth have been investigated, of which a number merit further.

The Sulphide Corporation Pty. Ltd., another wholly owned company of the Group, producing sulphuric acid, fertilizers and cement at Cockle Creek, New South Wales, are considering the construction of a new contact acid plant which will burn pyrites and in addition, are considering extending their super-phosphate plant to a size which will more than double its present capacity.

IMPERIAL SMELTING CORPORATION LTD.

The principal activities of the Consolidated Zinc Corporation Ltd. group in the United Kingdom are controlled through its holding of the whole of the ordinary shares of Imperial Smelting.

This company's principal activities are the production of zinc and sulphuric acid. At its smelting works at Avonmouth and Swansea, over 70,000 tons of zinc metal is produced per annum, and sulphuric acid plants at Swansea, Seaton Carew, Avonmouth and Newport provide some 220,000 tons of sulphuric acid per annum. Horizontal distillation plant processes at Avonmouth and Swansea were modified to obtain maximum recovery from the company's zinc concentrates. At Avonmouth, also, are plants for the production of cadmium, metallic arsenic and various alloys; chemical plants for the manufacture of sulphuric acid, vanadium catalyst and Cuprinol timber and textile preservative.

At Widnes, where lithopone, ground white barytes, zinc and cadmium sulphides are produced, the lithopone production figure exceeded that of 1951.

Mazak and Kayem are produced at Bloxwich, and in addition, a large proportion of the United Kingdom's zinc dust requirements.

In addition, the company owns three mines in England and Scotland, two of which produce barytes and one fluorspar. There is a fluorspar mill at Nenthead which has continued to work successfully and provide acid grade fluorspar for the fluorine chemical process.

Extension and modernization programmes throughout the Imperial Smelting group have progressed. One of the most important developments is a zinc smelting process with entirely new characteristics, known as the Imperial Smelting process which, from the operation of plants of commercial size has shown encouraging results. This is the outcome of many years of intensive research followed up by experiments on an intermediate pilot plant which justified full scale operations. The construction of a pyrites burning plant as an alternative raw material for sulphuric acid production continued and following successful operation at Swansea of an exit gas stripping plant to restrict atmospheric pollution, a similar plant is being installed at Avonmouth.

Research investigations in organic fluorine compounds have been undertaken and the application of some interesting products has been studied. The company was the first in this country to produce fluorine in a form of a compressed gas in cylinders. This will enable industry to explore the many uses for this element.

Tronoh-Malayan Tin Group

IT is not very often that the term "tin soldier" can be applied as a term of affection to a distinguished military personage. But General Sir Gerald Templer, Malaya's dynamic High Commissioner, is an exception for it is under his leadership that Malaya is winning the war against the Communist guerrillas. Indeed, the decrease in both the number and intensity of bandit attacks during the past year has been so marked that prospecting, though on a limited scale and confined to certain areas, is again becoming possible. This is news as cheering for the tin mining companies and Malaya as it is for shareholders because prospecting in Malaya has been at a standstill for rather more than 20 years.

Yet increased facilities for prospecting will bring its own problems. Modern prospecting is an expensive business and should payable deposits be found, the problem of raising anything up to £1,000,000 to finance the cost of a new dredge would bulk large to many tin mining companies. Moreover, the general opinion in tin mining circles is that the likelihood of proving anything but low-grade and perhaps deep areas is fairly remote. On the other hand, it is only fair to point out that the area now being mined is only about 645 sq. miles, or less than 1½ per cent of the total area of the Federation.

More than one chairman has declared that should E.P.L. be completely abolished and the capital allowances revised on plant and on depletion of property, the tin industry would press forward energetically with development. Mr. Butler's "incentive budget" presented in April provides for the abolition of E.P.L. as from January 1, 1954; the raising of the capital allowances on plant to 40 per cent for mines both at home and overseas and even lopped off 6d. in the standard rate. While the problem of the depletion allowances was left untouched it is hoped that when the Royal Commission on Taxation publishes its report, the provision of adequate depletion allowances will be strongly recommended.

In any event, the Tronoh-Malayan Tin group have not allowed time to stand still with regard to prospecting and a new company, Tromal Prospecting Ltd., has been formed to carry out this important work. This company is currently prospecting the sea bed off the coast of Siam. Encouraging results have been obtained and approval of the company's application for the issue of mining leases is awaited. Meanwhile, the question of equipping the area is under consideration and prospecting is continuing over areas adjoining the prospecting leases.

TRONOH MINES LTD.

Although the bulk of Tronoh Mines revenue comes from the operation of its four dredges, it has large outside interests. It has a wholly owned subsidiary, Tin Lay Ltd. operating in Siam; substantial interests in three other tin producers in the Tronoh-Malayan group—Sungei Way Dredging, Sungei Besi Mines, and Ayer Hitam Tin Dredging; a financial stake in Harrierville (Tronoh), the Australian gold dredging company which is nearing the end of treating tailings, with a consequent improvement in results; investments in British Government securities totalling £51,085; and a stake in the prospecting company, Tromal Prospecting Ltd.

During the year to December 31, 1951, the book value of quoted investments shaded off to £385,546, but the market value at the end of 1951 had risen to £788,675 against £703,700. The book value of the unquoted securities, representing mainly its interests in Harrierville (Tronoh) and Tromal Prospecting increased slightly to £37,030.

The output of tin ore in 1951 dropped appreciably, causing a fall in profits. Dividend payments, however, were raised to 115 per cent on the £300,000 issued capital, or 19½ per cent on the capital invested in the business, including profits ploughed back.

During 1952, Tronoh Mines made good some of the fall in output suffered in 1951. Production in the year to December 31, 1952, was 1,712 tons against 1,459 tons, and dividends for 1952 were maintained at 115 per cent. The first dividend interim for 1953 of 20 per cent is also at the same level as the first payment for 1952, and output for the first three months of the year totalled 429½ tons, an increase of 118½ tons over the corresponding period in 1952.

SOUTHERN TRONOH TIN DREDGING LTD.

The book value of this company's current assets at the end of December 1951 was £600,048 and current liabilities £218,147, making net current assets £381,901, against £371,924 at the end of 1950. Within the total of current assets, the composition of the individual items has changed greatly; balances at bankers and cash in hand were down to £27,353 as compared with £130,574, but the company held £204,625 in tax reserve certificates, an increase of £154,625. In addition, the company held a claim to a

tax refund of £37,174 which has been paid since the end of the financial year under review. The important change which took place during 1951 was the decline in the book value of quoted investments from £332,011 to £212,118.

The operating results for the year to December 31, 1951, were not so favourable as those of the preceding year, chiefly owing to the shortage of labour and the difficulty experienced in obtaining sufficient fuel to run the dredges to their capacity. At the meeting held on December 17, 1952, the chairman, Mr. J. H. Rich, said that this difficulty would be partly overcome when one of the two dredges had been converted to electricity, a task which would take about six months to complete.

The dividend distribution in respect of 1951 totalled 100 per cent on the issued capital of £200,000 or 42½ per cent on the capital invested in the business including profits ploughed back. During the calendar year 1952 dredging conditions were not good and the stiff patches of clay encountered made full recovery impossible. Consequently output declined 142 tons to 636 tons and the total distribution for the year was reduced to 50 per cent. During the first three months of the year ended December 31, 1953, output fell to 47 tons against 148 tons in the corresponding period of 1952, the sharp reduction being due to the No. 1 dredge being stopped for conversion to electric drive and replating its pontoon.

SUNGEI BESI MINES LTD.

The mining operations of Sungei Besi Mines Ltd. are of two different types. The first is the working by opencast methods of 400 acres under mining lease near Sungei Besi, Selangor, Malaya; the second is the operation of a dredge at Kota Tinggi, Johore, over an area of 1,084 acres, known as the Pelepah section.

Delays in obtaining equipment have hampered operations at the Sungei Besi section. A belt conveyor to transport karang from the mine to the treatment plant was not delivered, necessitating the karang being moved by wagons and endless rope. Similarly a percussion power drill, ordered and promised, was not delivered so that the comprehensive programme of drilling operations planned could not be undertaken. A new machine, however, was bought and drilling has started in the north opencast where the Japanese had left slimes in their excavations. This slime is being cleared to expose the richer ore lying below.

At the Pelepah section, the Sungei Pelepah River flows through tin-bearing land and in order that this area can be worked, the river is being diverted. Better results from the Pelepah section in the year to March 31, 1952, offset the decline of 46 tons in output at Sungei Besi and pushed up the total production to 53 tons more than in the preceding year.

The total distribution of 90 per cent (against 60 per cent) was equivalent to approximately 21 per cent on the capital invested in the business, including profits ploughed back.

During the year ended March 31, 1953, output of tin totalled 1,144 tons, an increase of 49 tons over the year under review.

AYER HITAM TIN DREDGING LTD.

During the year to June 30, 1952, Ayer Hitam Tin Dredging whose mining leases cover 1,930 acres in the Ulu Langat district of Selangor, Malaya, dredged 16 acres bringing the total acreage worked-out to approximately 166 acres. The company's dredge, designed to operate to a depth of 120 ft., treated 2,391,815 cu. yds. which was not radically different from that treated in the previous year. But the amount of ore recovered was almost exactly doubled at 1,769 tons, because in the early part of 1950-51, the dredge opened up a new face and values tended to be on the low side. The fall in the average price of tin during 1951-52 offset some of the benefit derived from this bigger output and mining costs were almost half as much again. Despite these influences, gross profit at £851,062 showed a welcome expansion. The tax authorities, too, took a slice of the larger cake, and out of the remainder, the directors were able to pay dividends amounting to 110 per cent on the issued capital of £180,000 or 28½ per cent on the capital invested in the business, including profits ploughed back.

The strength of the balance sheet grows with the passing years. At the end of June, 1952, current assets had a book value of £1,232,896 and current liabilities were a mere £364,511, leaving net current assets at £868,385. This figure is well in excess of the value of current assets at the end of the previous financial year, when net current assets were valued at £630,792.

Results in the current financial year have not reached the heights attained during the year under review. Output in the first nine months was only 815 tons against 1,457½ tons. But two interim dividends have already been declared totalling 50 per cent compared with three interim dividends declared in the

corresponding period of the year under review aggregating 60 per cent.

SUNGEI WAY DREDGING LTD.

Sungei Way Dredging is, in many ways, still suffering from the effects of damage done during the Japanese occupation. Of the three dredges owned by the company when Malaya was overrun, No. 1 was stripped beyond repair, No. 2 had to be overhauled, and No. 3 was dismantled but sufficient material was recovered to justify its rehabilitation.

In the year to June 30, 1952, the company brought its second dredge into operation. This dredge, No. 1A, was purchased from Malayan Tin Dredging to replace the old No. 1 dredge. It commenced working on April 5, 1952, but its early performance was marred by teething troubles and by the unfavourable nature of the ground. No. 2 dredge is reported to have worked satisfactorily during the year.

Progress has been made in re-erecting No. 3 dredge but considerable delay has been experienced in the delivery of the generating equipment. The troubles experienced in this sphere exemplify the difficulties which rearmament is causing tin producers in Malaya. The generating sets were first promised for the middle of 1951, but not until towards the end of 1952 were they shipped from the United Kingdom. The absence of this equipment has prevented the installation of the heaviest item of plant on the dredge. When this dredge is eventually working, Sungei Way will be able to re-commence treating its land on a substantial scale. It owns 1,277 acres of tin-bearing land at Sungei Way, Selangor, Malaya, of which 845 acres are held under sub-lease and the remainder, 382 acres, are in the company's own name.

The year's distribution consisted of a single payment of 10 per cent compared with 15 per cent, of which 5 per cent was an interim dividend and 10 per cent a final dividend.

Prospects for the current financial year are brighter, the output for the first nine months at 513 tons being more than double the 224 tons produced in the preceding year.

MALAYAN TIN DREDGING

In the year to June 30, 1952, Malayan Tin Dredging reaped the first fruits of its policy of re-organizing its four dredges.

As the table below indicates the amount of ore recovered was almost four times as much as in the previous year and consequently the amount received from sales, despite the lower price of tin, was greatly in excess of receipts in 1950-51. Naturally, this huge expansion in output had its effect on mining costs but as these were little more than doubled there was a large surplus of profits. The additional benefit which went to the tax authorities was comparatively small, but the time is rapidly approaching when tax losses and capital allowances will be used up and then the company will have a much heavier burden to bear. The company's dividend policy reflects the coming change, only £110,250 being distributed out of untaxed profits of £229,127. The re-organization plan is, however, still in the process of completion.

The company's properties are situated in the Kinta Valley, Perak, Malaya, and are divided into two sections: the old Batu Gajah section of 2,272 acres, which is now worked out apart from 63 acres suitable for gravel pump mining; and the new Kampong Gajah section of 2,536 acres which, when fully equipped with the company's four dredges, should yield an annual output of approximately 3,000 tons of ore a year.

The greater output of tin ore, was the result of two of the

dredges working on the Kampong Gajah section instead of, as in the preceding year, only one dredge working for two months out of the year. No. 3A dredge, which is the only new big bucket dredge introduced into Malaya since the war, commenced recovery in November 1951 and worked satisfactorily for the remainder of the financial year. No. 2A dredge operated for the whole of the year but recovery was not up to expectations owing to the high percentage of extremely fine concentrate found.

Results from the No. 5 dredge on the Batu Gajah section were not so good as expected, because much of the ground treated contained a large proportion of clay. For the first five months of the year No. 6 dredge retreated tailings in the Ipoh Tin Dredging sub-lease area, and thereafter it entered that portion of the Kinta River Reserve freed by the first section of the deviation of the river. When the work has been completed the company will receive a mining lease over 166 acres of this area, which is estimated to contain 13,500,000 cu. yd. of profitable dredging ground.

The improved results were acknowledged in the raising of the dividend distribution from 25 per cent to 85 per cent on the issued capital of £200,000 in 5s. shares, equivalent to 12½ per cent on the capital invested in the business, including profits ploughed back. During the current year the company repaid a loan of £380,000 by means of a new issue of 400,000 shares of 19s. each, which raised its issued capital to £300,000. Two interim dividends aggregating 60 per cent (15 per cent) have already been declared, a pleasant reminder that output for the first nine months at 1,494 tons reflected a big improvement over the corresponding figures of 635 tons achieved during the year under review.

SOUTHERN MALAYAN TIN DREDGING LTD.

In recent years, Southern Malayan Tin Dredging has been increasing its mining lease areas. During the year to June 30, 1952, another 653 acres were added to bring the total up to 5,876 acres, of which 2,479 acres had been dredged by the end of June 1952.

The company owns seven dredges, but one dredge—No. 2 Temoh section—has not been rehabilitated. Of the six in operation, four gave satisfactory service; these were No. 1 Temoh section, and Nos. 1, 3 and 4 in Tanjong Tualang section. The No. 2 dredge on the Tanjong Tualang section was docked during the year for a major overhaul, including the replating of its hull. Only one dredge in this section has not yet had its hull replated, and that operation is planned for 1953. The last dredge, No. 5 on the Teja section, continues to suffer from a shortage of labour, because of its inaccessibility.

Despite a decline in the amount of ground dredged, the quantity of ore recovered was 442 tons higher, due to the higher grade of ground treated and bigger tonnages recovered from the amang dumps and gravel pump workings. Once again the dividend payments were raised; on this occasion by 1s. to 6s., representing approximately 31 per cent on the capital invested in the business, including profits ploughed back.

The balance sheet at June 30, 1952, reflects the policy of ploughing back part of the profits in order to withstand future expenditure. Current assets were up at £2,376,539, and although current liabilities were also more at £979,617, net current assets rose from £1,141,697 to £1,396,922, equivalent to a shade over 16s. per 5s. share on the £432,500 issued capital.

During the first nine months of the current year output totalled 2,328½ tons—an increase of 110½ tons over the corresponding period of the year under review. Two interim dividends totalling 60 per cent (80 per cent) have already been declared.

SUMMARY OF OUTPUT, PROFIT AND TAXATION

Name of Company	Period Ending	Ground Treated	Tin Ore Recovery	INCOME			EXPENDITURE			Profit Before Tax	Govt. Tin Royalty (see Ore) Sales	Taxation	Dividends
				Ore Sales and Stock (less Govt. Tin Royalty) £	Tribute and Sundry Mine Revenue £	Interest, Dividends, etc. £	Mining Costs £	Head Office and Other Expenses £					
									£				
Malayan Tin Dredging Ltd.	30/6/52 30/6/51	8,970 5,061	1,141+ 319+	645,505 194,492	16,873 2,226	80,714 70,236	320,793 154,282	193,172 47,751	229,127 64,921	120,205 39,219	66,895 53,380	110,250 26,750	
Southern Malayan Tin Dredging Ltd.	30/6/52 30/6/51	13,869 14,927	3,116+ 2,674+	1,598,229 1,588,691	27,271 21,438	64,256 23,623	459,114 392,738	30,094 29,025	1,200,548 1,212,009	292,477 289,348	752,195 725,896	272,475 231,388	
Tronoh Mines Ltd.	31/12/51 31/12/50	5,781 7,460	1,460 2,114	923,648 971,896	78,299 74,008	128,946 125,090	390,355 313,366	27,757 20,413	712,781 837,215	169,647 171,859	416,374 345,799	182,625 165,000	
Southern Tronoh Tin Dredging Ltd.	31/12/51 31/12/50	3,296 3,538	777 847	506,462 374,513	14,760 4,387	17,647 18,183	170,000 133,939	40,111 17,212	328,758 245,932	95,269 66,618	216,230 122,700	106,000 99,000	
Ayer Hitam Tin Dredging Ltd.	30/6/52 30/6/51	2,392 2,346	1,769 894	1,006,597 598,007	1,494 638	18,315 14,810	152,457 106,238	22,887 17,153	851,062 490,064	177,587 108,159	501,365 280,734	103,950 63,450	
Sungei Besi Mines Ltd.	31/3/52 31/3/51	2,613 2,304	1,078 1,025	624,453 588,887	2,758 1,899	11,540 6,945	261,462 220,693	18,207 18,239	356,324 358,799	114,448 103,270	218,966 193,484	77,267 55,498	
Sungei Way Dredging Ltd.	30/6/52 30/6/51	1,812 1,336	385 383	222,991 245,083	6,409 1,510	7,021 7,137	128,004* 85,248*	16,087 11,555	92,331 156,928	† † †	9,104 28,088	14,012 22,018	

*Includes tribute payment of £12,293 in year to 30/6/51 and £11,241 in year to 30/6/52. †Includes recovery from amang dumps and tribute workings. ‡Not available.

Redruth-Malayan Tin Group

ALTHOUGH some of the mines in the Redruth-Malayan Tin Group have not come under direct attack by the Communist guerrillas, the potential threat of such an eventuality has been sufficiently great to involve the mines in taking defence measures adequate enough to ensure the safety of its employees. Such conditions are more productive of tension than tin so that the fact that terrorist activities have been on a steadily diminishing scale throughout the past year is welcome news indeed.

While the war in Malaya is far from over, General Sir Gerald Templar gave it as his opinion that the time had come when, in certain areas, a considerably increased amount of geological survey work could be carried out. Even more indicative, perhaps, of returning confidence was his announcement in March last that two representatives of the International Bank for Reconstruction and Development would visit Malaya last month with the object of arranging a basic survey of the economic resources and needs of the country.

No greater need exists than to throw open the country, including the Forest Reserve areas, for prospecting, but even if facilities were unlimited, the crippling rates of taxation borne by the industry would make it extremely difficult for companies to take full advantage of the opportunities available. The table opposite shows how much the Group's mines are paying away in tax of the traditional kind and clearly reveals the difficulties of building up sufficient reserves for further capital investment.

Fortunately, the group has taken the long view in matters of finance and some of the companies are in a strong financial position. Their position will be further strengthened by the recent Budget concessions, particularly the reduction of 6d. in the standard rate and the raising of the initial allowances on plant to 40 per cent. But even so, it is still true to say that once companies run down their liquid funds, their re-accumulation will be well-nigh impossible within a reasonable span of years in the face of the present burden of taxation.

RAMBUTAN LTD.

Nearly 94 per cent of Rambutan's revenue in the year to June 30, 1952, came from its tin mining operations, most of the remainder being derived from investments. Of the total revenue received, approximately 83 per cent arose from sales of tin and the other 11 per cent from tributes received. Thus, by far the most important part of Rambutan's income depends on the operating results in its two paddocks. During the year paddock "Y" provided 73 tons of tin ore and paddock "Z" 8.40 tons. Conditions in Paddock "Y" therefore largely govern the results obtained.

In recent years there have been difficulties in paddock "Y" because of the presence of large quantities of loose stones and the year under review was no exception in this respect. These stones reduce the amount of ground treated and the year's figures would have been disappointing but for the improvement in values at increased depths.

Paddock "Z" was opened in January, 1950 necessitating a great deal of work in removing the barren overburden—a task which continued for nine months of the year under review. In April 1952, however, sinking operations were commenced in the floor of the paddock with a small elevator and good values have been encountered at depth. The production of 8.40 tons compared with 3.45 tons in the previous year must be considered promising, for in future years the company will have a better spread of sources from which to derive its income.

Of the tribute workings, paddock "W" continued in production throughout the year, but the plant and equipment at paddock "X1" was transferred to open up paddock "X2," and operations at Toh Kiri were interrupted in April 1952 by the transfer of the plant to a new site.

The fall in production from 86 tons to 81½ tons and the drop in the price received per ton tin ore from £645 to £546 could not combine to produce a revenue figure large enough to cover the 77 per cent rise in working costs to £483 per ton. This upsurge was caused by the advances in the cost of both labour and material, together with abnormal expenditure incurred by the necessity of regrouping accommodation for the labour force to comply with Malaya's emergency regulations. Costs were further aggravated by the need to divert a Government road in order that the high values in the land adjoining the road can be worked. Profits were cut to about one-third at £13,689, and while the tax attracted was also much less, net profits at £7,855 were only about half

those of the previous year. The dividend was only reduced from 15 per cent to 10 per cent.

The amount of tin produced during the first nine months of the current financial year at 61½ tons shows an increase of about 4 tons over the corresponding period of the year under review. The financial results will depend on how much costs have fallen following the completion of the road deviation and on the price received per ton during the June quarter.

TEKKA LTD.

During the year ended March 31, 1952, Tekka worked its 956 acres of alluvial tin lands in the Kinta district of Perak, Malaya, with three 2½ in. hydraulic elevators, three 2 in. monitors and ten sluice boxes. The monitors continued to work the low-grade ground to the north, south and west of the paddock. In January 1952 a small enrichment was found in the dividing wall between the paddock and the tailings area to the west. This area gave improved outputs until March, but the average grade of ground treated fell by 0.02 lb. to 0.51 lb. per cu. yd.

Sinking has already commenced in the new area to the north and operations in depth confirmed the earlier boring results, that good values existed below the tailings and slimes overburden. The higher price of tin ruling during 1951-52 more than compensated for the reduction in output despite the considerable increase in costs from 14.6d. per cu. yd. to 17.07d., largely caused by the regrouping of accommodation for the labour force as a protection against bandit attacks. Untaxed profits were about £900 lower, but the amount provided for tax was smaller, with the result that taxed profits were £14,494 against £12,909. Dividends for the year were maintained at 5 per cent.

In the year to March 31, 1953, Tekka produced an extra 5½ tons of tin-ore to make a total of 109 tons, but the financial results must wait for the publication of the report and accounts later in the year. So far two interim dividends, each of 1½ per cent, have been paid for 1952-53; this repeats the practice of the previous year, which closed with a final dividend of 2½ per cent.

TEKKA TAIPING LTD.

On the whole the results achieved by Tekka Taiping during the year to October 31, 1951, were satisfactory considering the low-grade ground being worked. The volume of ground treated rose to 1,927,600 cu. yd. against 1,900,800 cu. yd. and the grade improved by 0.01 lb. per cu. yd. to 0.25. The amount of tin-ore recovered jumped to 214½ tons as compared with 200 tons. Production costs at the same time rose from £360 to £388 per ton tin-ore recovered, but as the financial year includes the period of record prices for tin, the price received rose from £405 to £633 per ton. The Malaya Government took its share of this prosperity, royalty payments being more than double at £34,967 and the tax payable either in Malaya or the U.K. rose from £9,176 to £65,822. Even so, the net profit was big enough to support the payment of a 10 per cent dividend against nil in the previous year.

The period 1951-52 is notable for another reason. The company's mining leases became due for renewal and the effect of new legislation became apparent. Before the war a lease renewal was normally granted free of premium, provided working conditions were observed. Now, a heavy premium is demanded and the rent has been doubled. Under these circumstances, Tekka Taiping examined the property carefully and decided not to keep 674 acres which were of no economic value and an application was made for the renewal of the lease over 1,322 acres for ten years. This area contains land, both worked and unworked.

The company is faced with the technical problem of improving the recovery of fine tin ore from the low grade deposits; this problem assumes a greater urgency now that the price of tin has started to fall again.

During the year to October 31, 1952, the dredge was shut down for pontoon repairs and a general overhaul. This fact was reflected in the output figures for the year, production being only 210 tons against 294 tons. Up to the time of going to press, only one interim dividend of 2½ per cent has been paid on account of 1951-52.

The repairs to the dredge have also affected the results for the year to October 31, 1953, as it was not recommissioned until mid-December, therefore causing a loss of about six weeks production.

This loss of dredging time is perhaps the reason why output for the first five months at 89½ tons was over 46 tons lower than the corresponding production total in the preceding year.

PENGKALEN LTD.

By September 30, 1951, Pengkalen had dredged about 425 acres of its land. It possesses about 800 acres of tin bearing land at Pengkalen, Lahat, Malaya, and holds mining leases over another 226 acres; in addition it holds mining leases over 81 acres contained in the Kinta River area. During 1951-52, the dredge entered the river reserve released by the deviation of the Kinta River and started on a southerly course along the old river bed. Apart from the loss of time caused by the presence of large timber in the bed, dredging proceeded satisfactorily and the output of tin ore was virtually unchanged at 555 tons, despite the fall in the grade of ground worked from 0.72 lb. to 0.65 lb. per cu. yd.

The heights to which the price of tin soared in 1950-51 are indicated by the rise in the average price received for ore, from £387 to £645 per ton. This easily accommodated the higher costs of power, labour and materials and the expenditure caused by the disturbed political conditions. Net profits at £124,456 were almost doubled. Distribution on the ordinary issued share capital of £90,000 in 5s. shares was increased from 45 per cent to 50 per cent, while the distribution on the preference ordinary share capital of £70,000 in 5s. shares was raised from 55 per cent to 60 per cent. The sum of £77,206 was ploughed back into the business.

At the end of the year under review Pengkalen held £250,410 in cash, and net current assets stood at £374,000 as compared with an issued capital of £160,000.

The operating results for the year to September 30, 1952, were slightly below those of 1951-52; output being 24 tons down at 531½ tons, and some fall in the price received per ton tin seems probable. The board has, however, maintained the interims for the year at 50 per cent on the ordinary and 60 per cent on the preference ordinary, which may reduce the margin between the dividend and earnings.

During the first half of the current financial year, Pengkalen's output has fallen away from 273 tons to 161½ tons and the first interim dividend for 1952-53 has been reduced on the ordinary shares to 5 per cent against 10 per cent paid in the corresponding period of the preceding year.

KENT (F.M.S.) TIN DREDGING LTD.

Kent (F.M.S.) owns some 645 acres in the Kuala Lumpur area, Selangor, Malaya, of which 35 acres are held on a mining lease direct from the Government and 610 acres on a sub-mining lease, tribute being payable on a sliding scale based on the price of tin. This latter arrangement, though slightly complicated, is useful as it provides a small shock absorber as and when the price of tin declines.

Once again, the results for the year to December 31, 1951, showed an improvement over those of the previous period. The recovery of 549 tons against 514 tons was due to the increase of 0.07 lb. to 0.72 lb. per cu. yd., in the grade of the ground treated. While working costs per cu. yd. rose from 11.12d. to 11.58d., the greater tonnage of output enabled production costs per ton to be reduced from £158 to £151. At the same time the price received was 37 per cent more at £616 per ton. Consequently

profits expanded and even after allowing for tax, net profits went up from £59,640 to £98,493 and dividends aggregating 100 per cent per 2s. share were paid, as compared with 57½ per cent in the preceding year.

The year to December 31, 1952, saw a set-back to the recent series of continued improvements. The price received per ton of ore was almost certainly lower than in 1951, and it will relate to the smaller output of 478 tons, as compared with 549 tons. When the accounts for 1952 are published, the results will probably be seen to be satisfactory, bearing in mind that 1951 was an exceptional year. The dividends paid so far on the £105,000 issued capital amount to 70 per cent for 1952.

Output in the first quarter of the current financial year was 122½ tons against 121½ tons. During this year, the question of the price of tin will assume a greater significance than in 1952. The current year will also see the diversion of the Batu River into a new channel.

GOPENG CONSOLIDATED LTD.

The main asset owned by Gopeng Consolidated is the 1,860 acres of tin bearing land at Gopeng, Perak, Malaya, but it also holds a joint interest, with Kinta Tin Mines, in a further 2,200 acres of tin bearing land and in Sanglop Rubber Estates Ltd. which has 825 acres under cultivation. In addition, it owns the Moynalpy Rubber Estate which has 563 acres under rubber.

During the year to September 30, 1951, the price of tin reached record levels, though by the end of the period, the price had fallen sharply. Nevertheless, the accounts were dominated by the fact that the price received of £642 per ton tin ore was 63 per cent higher than the £393 in the preceding year. So great a change in price completely offset the comparatively small decline in the amount of ore treated. With the grade of ground treated remaining unchanged, at 0.81 lb. per cu. yd., output dropped 28 tons to 800 tons. The higher price was also sufficient to outweigh the jump in costs from 8.14d. per cu. yd. to 11.79d. and to leave the working profit £171,000 higher at £431,615. The price of rubber during the period was also favourable, and revenue from this source accounted for about £22,000 of the increase. Tax liabilities rose sharply. In addition to the charge shown in the table opposite the Malaya Government also received £95,381 in royalty and tin-duty, bringing total payments to Governments to £377,581, or £472 per ton ore produced. Shareholders partook in the prosperity and received dividends totalling 60 per cent against 42½ per cent.

The fall of 28 tons in the year's output was due to the absence of any tin ore from sluicing the high ground along the Koota Bahru road, which yielded 58 tons in 1949-50, and from a fall in the tonnage obtained from No. 3 paddock where a further subsidence of ground under the up-air pipes caused the elevators to be transferred.

In the year to September 30, 1952, output, according to the quarterly reports, totalled 856½ tons against 800½ tons, and although no official profits figures have yet been published the lower average price for tin in 1951-52 has undoubtedly left its mark. This supposition receives support from the reduction in the dividends paid from 60 per cent to 50 per cent. During the first six months of the current year ending September 30, 1953, output has fallen to 336½ tons compared with 444½ tons in the corresponding period of the preceding year and the first interim dividend distribution has been reduced from 12½ per cent to 10 per cent.

SUMMARY OF OUTPUT, MINING PROFIT AND TAXATION

Name of Company	Period	Ground Treated (000 cu. yd.)	Tin Ore Recovery (tons)	Ore Sales £	LESS				PLUS		Mining Profit £	PLUS		Head Office and Other Expenses £	Profit Before Tax £	Tax £	Dividend £
					Govt. Royalty £	Smelters' Charges £	Tribute on Ore sold £	Mining Expenditure £	Sundry Revenue from Tribute, etc. £			Sundry Revenue £					
Gopeng Consol.	30/9/51 30/9/50	2,187 2,271	800 828	610,951 386,462	95,381 59,276	2,405 2,028	—	107,465 77,087	25,915 12,504	431,615 260,575	59,796 29,465	16,406 16,816	474,905 273,224	282,200 151,758	126,151 92,511		
Kambutan	30/6/52 30/6/51	269 448	81 86	53,365 65,762	8,577 10,326	261 237	17 7	39,333 23,259	7,174 7,053	12,351 38,986	4,215 4,079	2,877 3,937	13,689 39,128	5,834 23,310	5,250 8,125		
Tekka	31/3/52 31/3/51	462 461	103 110	68,410 64,818	11,067 10,683	333 304	4,794 5,383	32,867 28,062	4,072 5,407	23,421 25,793	12,666 11,329	2,693 2,830	33,394 34,292	17,685 21,418	9,413 12,102		
Tekka-Taiping	31/10/51 31/10/50	1,928 1,900	294 200	221,414 95,999	34,967 14,744	175 127	—	83,336 72,036	496 455	103,432 9,547	10,660 7,149	8,316 3,437	105,776 13,259	65,822 9,176	21,249 —		
Pengkalen	30/9/51 30/9/50	1,923 1,759	555 561	436,100 261,069	67,289 39,253	1,579 1,297	8,971 3,294	84,272 62,762	15,201 10,877	289,190 165,340	12,229 7,318	15,545 10,153	285,874 162,505	161,418 94,974	46,250 43,450		
Kent (F.M.S.)	31/12/51 31/12/50	1,718 1,751	549 514	409,035 280,473	63,395 42,198	1,601 1,291	5,530 6,114	82,929 81,115	401 472	255,782 150,227	3,178 1,987	12,999 8,860	245,961 143,354	147,468 83,714	55,125 32,878		

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A. O. Nigeria, Ltd. - - - - Jos, Northern Nigeria

A. O. (Australia) Pty. Ltd. - - - - Sydney, N.S.W.

Tanjong Tin Dredging Ltd.

WITH full 12 months' working of the additional dredge acquired in the amalgamation with Sungei Luas Tin Dredging Co., the output of tin ore, as stated in last year's *Annual Review*, was increased by 700 tons to 1,154 tons. While this robs the following note of any surprise element, it is not without interest to analyse the operating statistics to see how these excellent results were achieved.

Year to	Dredged	Per Cubic Yard Yield	Cost	Output
Dec. 31, 1951	4,397,400	0.59 lb.	8.6d.	1,154 tons
Dec. 31, 1950	1,763,400	0.57 lb.	10.2d.	453 tons

With dredging conditions good, the grade of ground showing a slight improvement, and the company having two dredges in action throughout the whole of the year, the increase in the volume of ground treated amounted to no less than 2,600,000 cu. yd. more than in the preceding year. Even allowing for the fact that the commissioning of the second dredge was not effected until the beginning of December 1950 so that the 1950 figures show the benefit derived from only one month's working with two dredges, the improvement is impressive. In any event, it meant that the unit costs per cu. yd. were lightly borne and enabled the company to record for the fourth year in succession a reduction in working costs to the now very low figure of 8.6d. per cu. yd.

Furthermore, the price received per ton tin ore advanced £148 to £633 and with output higher by 701 tons compared with 1950, the full benefits of the year's work came to the company in receipts from ore sales.

Year to	Ore† Sales	Costs at Mine	Tax-ation	Net Profit	Divi-dend %	To Reserves
Dec. 31						
1951	730,261	162,479	306,859	235,931	100	100,000*
1950	219,504	73,972	68,000	68,503	25	45,000*

*Excluding £1,000 allocated to investment reserve in both years.

†Less duty and charges, etc.

The revenue from sale of 1,154 tons of ore given in the above table indicates an increase over the preceding year of £510,757.

Kinta Tin Mines

KINTA TIN MINES, situated near Gopeng, Malaya, works its 1,079 acres of tin-bearing land by hydraulic mining equipment. The volume of ground which can be treated, therefore, over any given period depends largely on the amount of water available for cutting.

During 1951, the company experienced a prolonged dry spell between March and September which reduced the amount of water available for cutting and this, together with the necessity of concentrating operations between March and November in the lower lift at the Damak section, resulted in a reduction in the total volume of ground treated from 1,209,100 cu. yd. to 855,000 cu. yd.—a decrease of approximately 354,000 cu. yd. By November the new paddock had been sunk to 140 ft. enabling additional cutting water to be transferred to the company's other main section at Lallang.

Year to	Treated	Per Cubic Yard Yield	Cost	Output
Dec. 31, 1951	855,000	1.00 lb.	17.0d.	381 tons
Dec. 31, 1950	1,209,100	0.75 lb.	9.8d.	403 tons

Yield per cu. yd. in both sections was better than in the previous year; Damak showed an average return of 1.24 lb. per cu. yd. against 0.76 lb. per cu. yd. in 1950; and Lallang gave an average return of 0.89 lb. per cu. yd. compared with 0.72 lb. per cu. yd. Thus average yield was 1.00 lb. per cu. yd., an improvement of 25 per cent over the preceding year. In spite of the higher ratio of tin recovery per cu. yd. treated, working costs per cu. yd. rose by 7.2d. to 1s. 5d., although this figure also bore the increased payments necessary to meet the costs of labour and materials as well as the expenditure required for the regrouping of the company's labour force in accordance with Malaya's Emergency Regulations. The price received per ton tin ore, however, at £629 2s. 10d. compared with £468 18s. 7d. in 1950 was a big enough improvement to more than offset the reduction in tonnage output by 22 tons to 381 tons.

Year to	Ore* Sales	Costs at Mine	Tax	Net Profit	To Reserve	Divi-dend %
Dec. 31						
1951	240,514	62,397	140,070	78,583	28,500	75
1950	188,696	50,539	98,511	65,024	32,000	65

*Less duty and charges.

Revenue from ore sales, less £44,829 paid to the Malayan Government in royalties and less £1,140 other charges, amounted to £240,514, an increase of £51,818 over the previous year. Tribute and sundry revenue fell moderately to £12,405 (£14,797)

But this was struck only after paying to the Malayan Government Royalty charges of over £116 per ton and providing for realization charges which together required £138,642. Total mining costs, were, of course, heavier. If Royalty charges are taken together with the tax liabilities it will be seen that the Exchequers of Malaya and the U.K. took no less than 67.8 per cent of the profits or a sum equivalent to £382 16s. per ton.

The shareholders' slice of the cake required £98,724, equivalent to a mere 15.1 per cent of the profits or £85 5s. per ton. The carry forward at the financial year-end stood at £42,857 against £6,282 brought in.

The balance sheet at December 31, 1951 showed the company to be in a strong financial position. Current assets totalled £613,579 against current liabilities of £192,330 giving a net liquid asset figure of £421,249 which is more than twice the issued capital of £185,834. The company had, however, capital commitments outstanding at the end of 1952 amounting to £113,539—but this does not represent any strain on the company's resources.

The balance sheet also disclosed that the amount received on rehabilitation account remains at £155,560, against which the company has expended £83,651 on the No. 1 dredge and buildings. The total expenditure to date on No. 2 dredge amounted to £273,519 which remains to be apportioned as between rehabilitation and additions and improvements.

The outlook for the year 1952, while good, will not stand close comparison with the results obtained during the year under review. For one thing E.P.L. will mean an additional tax burden of probably 10 per cent; total output for 1952 at 981 tons falls short by 173 tons compared with 1951; the price of tin, though steady at a profitable level, will be lower on the average than in the year under review. On the other hand 1952 can be viewed as rather an exceptional year and shareholders who have already received four interim dividends totalling 80 per cent can well afford to take the long term view.

For the year 1953 a first quarterly interim dividend of 15 per cent was declared payable on April 10.

but income from dividends and interest mounted from £6,152 to £24,237—an advance almost wholly due to the increased dividend received on its holding of 82,052 shares in Tanjong Tin Dredging. Profits from the adjoining Sanglop Rubber Estate, in which Kinta owns a half interest together with Gopeng Consolidated, remained virtually unchanged at £17,452 compared with £17,580. Taking into account all other income items totalling £612, gross revenue for the year 1951 totalled £295,220, an expansion of £67,661 over the previous year.

Mining costs, for the aforementioned reasons were heavier as were total tax liabilities which, if taken together with the Royalty charges paid, absorbed as much as 69.31 per cent of the profits, or a sum equivalent to £485.17 per ton.

While the risk bearing shareholder received 75 per cent per 5s. share on the £120,000 issued capital—the largest distribution ever made by the company—it is worth noting that the net payment required of £47,700 was only 17.8 per cent of the profits earned, or equivalent to £125.16 per ton. The sum of £25,000 (£30,000) was allocated to general reserve raising its total to £155,000, and £3,500 to investment reserve thereby raising that account to £5,500. The carry forward at the financial year-end stood at £13,954 compared with £11,893 brought in.

The balance sheet disclosed some interesting changes. Holdings in gilt-edged securities at £46,316 remained unchanged. But shareholdings in Malayan Tin Companies, at cost, declined from £4,123 to £3,773, yet the market value of the smaller holding at the end of 1951 was £10,395 against £7,304.

Seventy thousand of the Tanjong Tin shares held by Kinta Tin for its property reserve account, remain unchanged at their book cost at £18,035 but the market value at December 31, 1951, went ahead to £60,375 compared with £39,375 at the end of 1950.

It is unlikely that results in 1952 will equal those obtained during the year under review. Output for the year at 305 tons represents a reduction of 76 tons; the average price received per ton will be less; E.P.L. will probably mean an overall increase of 10 per cent in taxation liabilities; and income from Tanjong Tin Dredging and the Sanglop Rubber Estate will also be lower.

So far four interim dividends have been declared in respect of 1952 totalling 40 per cent which compares with 70 per cent paid in the corresponding period during the year under review.

For the year 1953 a first quarterly interim dividend of 10 per cent has been declared payable on April 10.

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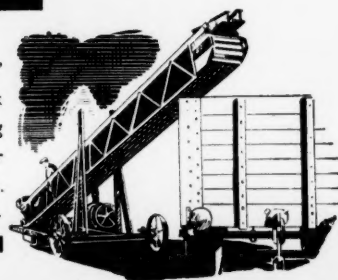
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Petaling Tin Ltd.

PETALING TIN, the important Malayan incorporated tin producer, employed its three dredges, Nos. 3, 5 and 6, to good effect during the year ended October 31, 1952. While profits earned did not equate last year's record earnings they were, nevertheless, highly satisfactory.

Year to	Treated	Per Cubic Yard	Output	Per Ton Ore
Oct. 31	Cubic Yard	Yield	Cost	Cost
	(000)	(lb.)	(pence)	(tons)
1952	9,563.1	0.47	11.2	2,003
1951	8,447.9	0.51	10.7	2,129
1950	7,976.4	0.52	7.1	1,874
				126
				406

*Less tribute.

REDUCED AVERAGE RECOVERY

The volume of ground treated was an outstanding feature marred only by No. 5 dredge having to cross its former dredging course which meant working through tailings for two months. This reduced the average recovery per cu. yd. with the result that total output was 126 tons lower than in the preceding year. Production costs, though higher by £45 per ton, represented a smaller increase per ton produced than in the preceding year. But the price received per ton tin ore fell by £69 to £577 so that mining revenue suffered accordingly.

Year to	Mining	Mining	Taxation	Net	Divi-	To
Oct. 31	Revenue*	Costs†		Profit	dends	Reserve
	£	£	£	£	%	£
1952	1,172,162	445,106	233,333	419,354	105	58,333
1951	1,391,139	377,536	259,000	645,880	150	116,667
1950	774,796	240,902	81,667	376,535	85	175,000

*Proceeds from tin-ore, gold, ilmenite and tribute collected. The 1952 figure also includes 2.8 tons of monazite.

†Including provision for plant renewals.

Total revenue from mining operations of £1,172,162 consisted of receipts from the sale of 2,003 tons tin-ore amounting to £1,155,725; of 192 oz. gold amounting to £2,353; of 5,203 tons ilmenite amounting to £11,342; of 2.8 tons of monazite amounting to £181; and finally, receipts from tribute workings carried out in the Sungei Way north area, amounting to £2,561.

With mining revenue lower, costs higher and no real amelioration in the tax burden, net profit, after providing for these outgoings and all other expenses, contracted by £226,526 to

£419,354. That taxation liabilities were not somewhat lighter was due to the inclusion of approximately £35,000 in respect of the excess of the war damage compensation credit over the balance of rehabilitation expenditure remaining to be allowed as a deduction under the income tax regulations, which falls to be treated as income.

All points considered shareholders did well, receiving three interims of 25 per cent and, one of 20 per cent making with the final of 10 per cent, 105 per cent for the year which required a net amount of £377,300. These payments were distributed on an issued capital which, at the current exchange rate of 2s. 4d. per Straits dollar, totals £513,333 divided into 4,400,000 shares of 2s. 4d. each. £58,333 was added to general reserve leaving the carry forward at £91,756 against £109,222 brought in.

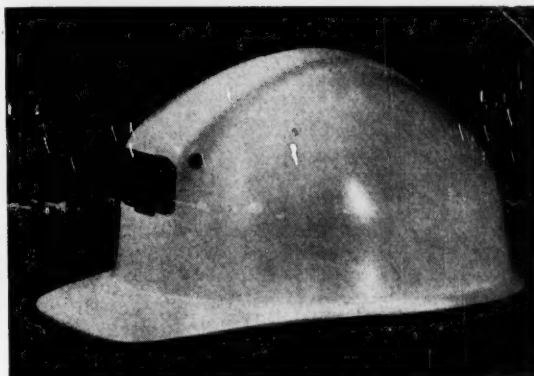
Although the company's application to convert to mining title 538 acres belonging to Seaport (Selangor) Rubber Estate Ltd., and 27 acres adjoining the No. 3 dredge course, belonging to Petaling Rubber Estates, were approved last year, only the latter area is at present being worked. The company is not, at present, in a position to work the Seaport Estate area as all the material required in connection with transferring No. 5 dredge to the area will not be delivered until the end of this year. During the year under review a mining lease over approximately 15 acres of land adjoining the company's Sungei Way north area was acquired and sublet to the tributor.

STEADY PROSPECTS

Technically speaking prospects for the current year continue on a par with the year under review. Two of the three dredges, Nos. 5 and 6, will be working in ground of good average value in the Puchong area and although No. 3 dredge is expected to yield lower returns, the forecast by Mr. J. T. Chappel, chairman, in his statement accompanying the report and accounts, is that the rate of production should be maintained. However, the lower average price ruling could result in a modest cut in the total distribution.

During the first five months of the current year ending October 31, 1953, output totalled 806 tons compared with 868 tons in the corresponding period in the year under review, and a first interim dividend of 20 per cent (25 per cent) has already been declared.

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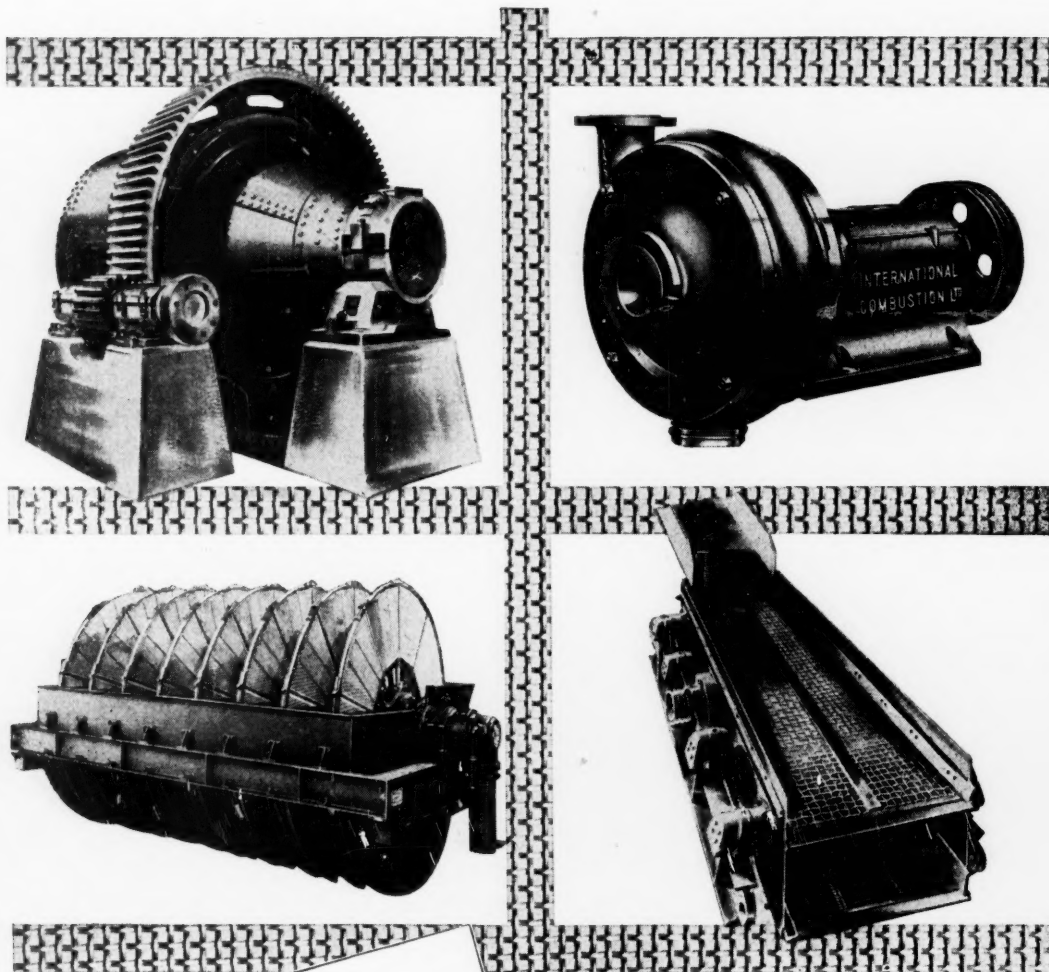
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Kinta Kellas Tin Dredging Co. Ltd.

THE operating statistics for the past three financial years of Kinta Kellas Tin Dredging, set out in the table below, provide a clear explanation as to why operations during the year to March 31, 1952 were on a smaller scale than in the two preceding years.

Year to Mar. 31	Dredging Time (hours)	Per Cubic Dredged (000)	Yard Yield (lb.)	Output (Tin Ore) (tons)	Per Ton Cost £	Tin Ore Price £
1952	5,444	1,062.1	0.50	237	362	581
1951	6,587	1,243.2	0.45	249	312	557
1950	6,373	1,610.6	0.49	353	201	350

With one dredge to work its large property it is essential for the company to keep its dredge working steadily throughout the year if good results are to be achieved. Unfortunately, this was not possible during the year to March 31 last owing to dredge running time being affected by stoppages for repairs and replacements, including the fitting of a new bucket band. The result was that the effective dredge running time was reduced to 5,444 hours or 1,143 hours less than in the previous year. If a normal working day for the dredge is reckoned at 19 hours the loss of working time compared with the preceding year, was 60 days, equivalent to a full two months' operations.

IMPORTANCE OF YIELD

The importance of the yield per cu. yd. in these circumstances is, then, obvious and the fact that the grade of ground worked improved by 10 per cent nearly offset the disadvantages, so far as production was concerned, of a much reduced dredge throughput. However, it could not counter the £50 per ton rise in costs which were also too much to be offset by the rise of £24 to £581 in the price received per ton.

Year to Mar. 31	Tin Proceeds £	Gross Revenue £	Mining* Costs £	Taxa- tion £	Net Profit £	Divi- dend %
1952	137,748	147,266	98,128	21,035	24,590	20
1951	138,605	144,083	90,039	35,006	15,689	25
1950	123,553	125,531	82,319	28,631	11,207	20

*Including royalty payments and depreciation.

Nevertheless, proceeds from tin ore sold almost equalled that obtained in the preceding year. While gross revenue, materially assisted by tribute income and sundries which increased from £3,541 to £7,297, was some £3,000 higher, mining costs were heavier and profit, before tax, was reduced to £45,624 compared with £50,695 in the preceding year.

Nearly half of this amount was taken in taxation, approximately a quarter of it went to shareholders who received 20 per cent per 5s. share on the £105,000 issued capital, which required a net amount of £11,025, and the remainder was appropriated as between additional dredge renewals £6,500, contingency reserve fund £5,000, and depreciation of dredged land £2,000. During the year the company received £35,418 on account for its war damage claim. This was reduced to a net £17,718 after meeting tax liabilities and was applied into writing off its rehabilitation costs. This charge has now been written off in full, the total amount being £49,476. The carry forward at the financial year-end was £10,553 compared with £10,270 brought in.

STRONG FINANCIAL POSITION

The balance sheet showed the company to be in a strong financial position. Current assets were recorded at £123,418 and current liabilities at £59,118, giving a net current asset figure of £64,300. Investments, at cost, totalled £49,347 (market value: £46,650), so that taken together with the net current asset figure quick assets totalled £113,647, or £8,647 more than the issued capital. Under "Fixed Assets" in the balance sheet, the historical cost of the company's dredge was given at £67,590. This has been depreciated down to a mere £6,187 which it is hoped to write off during the current year. Yet it may well be that this worthy objective will have to wait another year. For during the current year ended March 31 last dredge running time has been severely affected by stoppages for extensive repairs and a partial major overhaul. While this has put the dredge in good condition and no further loss of running time is expected for some time ahead, it has meant that the company suffered a trading loss at the end of the first nine months of the current year and also caused the usual interim dividend to be passed. However, when the accounts for the year become available it is hoped that the payment of a dividend may be possible. Output for the year to March 31 last totalled 184 tons compared with 237 tons during the year under review.

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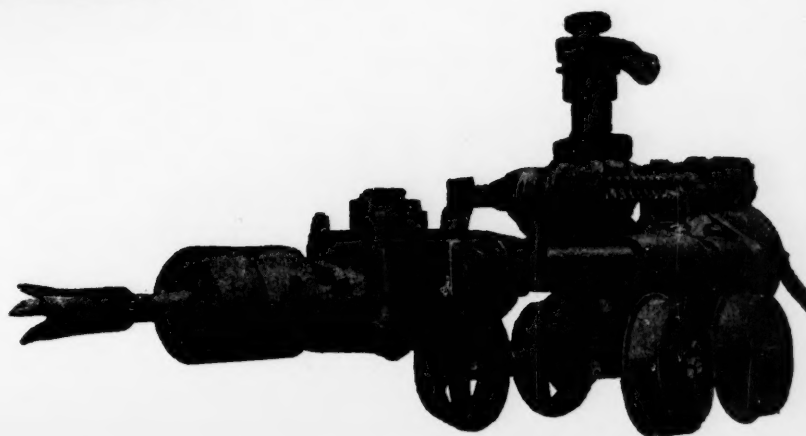
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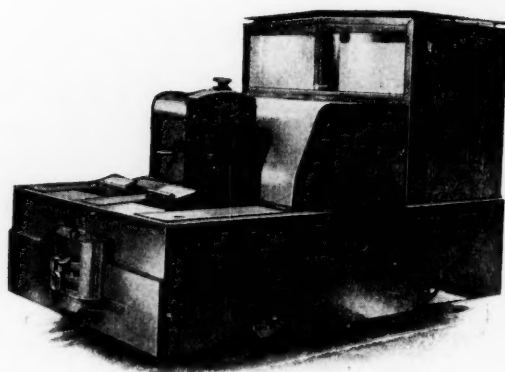
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Malaysiam Tin Ltd.

At the annual meeting convened to deal with the report and accounts of Malaysiam Tin for the year ended March 31, 1950, Sir Joseph Ball, chairman, explained to shareholders that the future prospects of the company depended largely on the development of the Tanjong Ara area, as the former high-grade Rambun section and the lower-grade Sungei Choh section were nearing the end of their working lives. Accordingly during 1951 every effort was directed towards preparing the Tanjong Ara area for production. This involved the time consuming but unproductive task of stripping the barren overburden overlaying the virgin tin-bearing ground and resulted in output falling to 54.4 tons from the 107 tons produced in 1950.

Year to March 31	Treated (cu. yd.)	Per Cubic Yard		Output (tons)	Per Ton Ore	
		Yield (lb.)	Cost s. d.		Cost £	Price £
1952	397,500	0.31	1 10*	54	665*	580
1951	407,500	0.29	1 3	54.4	472	553
1950	503,000	0.48	1 3	107	288	345

*Including cost of regrouping accommodation for labour force.

During the year ended March 31, 1952, the company continued to concentrate the bulk of its factors of production in the Tanjong Ara area. Recovery per cu. yd. was not high but the monitors were still stripping barren overburden containing a large amount of stones which reduced the volume and the grade of the ground treated. Even so, 98,600 cu. yd. were treated in this area averaging 0.40 lb. per cu. yd. which compares with 101,400 cu. yd. yielding 0.05 lb. per cu. yd. in the preceding year. This was of great assistance to the year's final result for the Rambun section gave an uneconomic return; the 191,700 cu. yd. treated yielding an average of only 0.13 lb. per cu. yd. compared with 174,700 cu. yd. yielding 0.55 lb. per cu. yd. in the preceding year. Consequently, mining in this section, except for small-scale tribute operations in the floor of the paddock, was discontinued. The Sungei Choh section however, which is also believed to be nearing the end of its life, yielded much better results and 107,200 cu. yd. were treated for a tin ore recovery averaging 0.53 lb. per cu. yd. compared with 131,400 cu. yd. averaging 0.16 lb. per cu. yd. Thus mining charges were inevitably higher. But working costs would have risen in any event for quite apart from the increased cost of labour, materials

and power the company was compelled to find £4,692 out of its own resources, for the re-settlement of its labour forces to comply with Malaya's Emergency Regulations. But for this large expenditure the company may well have paid a dividend for the year—albeit at a lower rate than the 5 per cent paid last year. But as things stood, with a reduction of £3,845 in its revenue from tin ore sales (including tribute revenue which dropped by no less than 43 per cent, 6,511 against 11,546), and mining costs some £6,000 higher, there was no alternative but to pass the dividend.

Year to March 31	Tin* Proceeds	Mining Costs	Tax	Net Profit	To Reserve	Carry Forward
	£	£	£	£	£	£
1952	37,808	31,541	3,044	4,734	3,000	2,295
1951	41,653	25,738	11,856	6,836	5,000	5,253
1950	42,182	30,750	5,179	4,240	3,000	7,325

*Including net revenue from tributors' workings.

As can be seen from the above table, after providing for the regrouping of its labour force only £42 remained of the freely represents a transference of funds from the forward balance.

The outlook for the current year is much improved and possibilities are that the company might return to the list of dividend payers. Estimated output totalled 67.01 tons, an increase of 12.61 tons over the year under review; costs should show a substantial reduction, since the closing down of the Rambun section enabled the redundant labour force to be discharged; and finally estimated profit from the Tambun Rubber Estate was £1,318 as compared with £2,560 during the year under review.

In the longer term, prospects are more difficult to assess. This is because on February 26 last the lower lift pump in the Tanjong Ara area was over-run by a large slide of tailings following a period of heavy rainfall. Every effort is being directed towards clearing the accumulated sand and slimes and to recover the buried plant but it is not yet known what the prospects now are of continuing operations in this area. Meanwhile, the company is covering its working expenses by developing a small lead, hitherto unnoticed, and overlain with sand and slimes, in the Sungei Choh area. It is therefore essential that this newly discovered area continue to yield good results until the Tanjong Ara area can once more be worked.

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Siamese Tin Syndicate Ltd.

IN mining matters Siamese Tin Syndicate is usually associated with Siam where it is easily the largest and most important mining company. But during 1952 the company caused a considerable stir in United Kingdom mining circles by its proposal to investigate the possibilities of re-working old lead-zinc properties in the Wanlockhead-Leadhills area in Scotland.

THE WANLOCKHEAD-LEADHILLS SCHEME

The initial work on this scheme, which was limited to a practical investigation of the mines by hand methods, was carried out by the company and its associate, Bangrin Tin Dredging. The results obtained were encouraging and it was decided to investigate further. For this purpose the company, in partnership with Bangrin Tin Dredging, entered into an agreement with the Rio Tinto Co. to carry out a thorough examination of the old workings. Under the agreement Rio Tinto will provide 51 per cent of the necessary funds and Siamese Tin and Bangrin Tin will jointly provide 49 per cent.

Shareholders duly confirmed these arrangements at an extraordinary meeting held on December 17, 1952.

OPERATIONS IN SIAM

Turning to the company's mining operations in Siam, where it operates a fleet of five dredges on four different properties, and in Malaya, where its wholly owned subsidiary, Siamese Tin Syndicate (Malaya), operates another dredge to work a property at Kota Bahru, results for the calendar year 1951 were impressive.

The total yardage treated was approximately 1,000,000 cu. yd. below the previous year's throughput, due almost entirely to the dredge at Kota Bahru being out of action from the middle of March to the end of the year. But the loss of production which this entailed, a matter of some 41 tons, was approximately offset

by the higher output obtained from its dredging properties in the Takuapa area and in the Renong district.

Year	Dredged (000 cu.yd.)	Yield (lb. cu.yd.)	Output (tons ore)	Per Ton Ore Price	Duty	Tin Ore Proceeds
1951	7,469	0.47	1,564*	£721	£103	£1,170,954
1950	8,470	0.40	1,525†	£572	£89	£948,003

*Excluding 61 tons recovered from tailings.

†Excluding 133 tons recovered from tailings.

Although the tonnage total recovered, including the 61 tons from the retreatment of tin shed tailings, showed a small decline when compared with total production from all sources in 1950, the advance in the average price realized per ton of nearly £150 lifted tin ore proceeds to a figure well above that obtained in the preceding year.

Year	Mining Revenue	Mining Costs	Taxation†	Net Profit	Divi- dend %	Carry Forward
1951	1,172,141	681,264	311,800	177,535	150	43,501
1950	949,664	578,637	213,262	136,970	125*	76,466

*Including special interim dividend of 50 per cent paid during 1951.

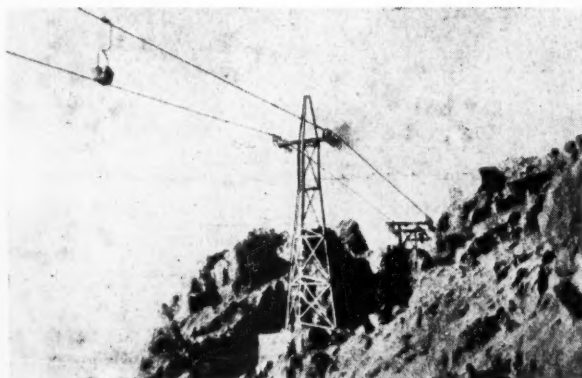
†Net Siam and U.K. Estimated Taxation.

While the expansion in revenue was to some extent offset by an increase in mining costs of approximately £103,000 earnings before tax at £489,335 represented an improvement of more than £139,000 over 1950 and were, in fact, the highest achieved by the company since its incorporation in 1906. U.K. taxation was heavy, but about £89,000 was remitted in respect of Siamese Tax.

The outlook for 1952 is good. Total production for the year from direct dredging operations at 1,833 tons shows an increase of 269 tons over that achieved during the year under review, indicative, in part, of the resumption of operations by the Kota Bahru dredge in February 1952. The average price for tin, however, will be lower and the company will have to reckon with E.P.L. which may increase its overall tax liabilities.

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Bangrin Tin Dredging Ltd.

THE higher average value of the ground dredged by Bangrin Tin Dredging, daughter company of Siamese Tin Syndicate, during 1951 enabled it to overcome completely the disadvantages of having to forgo the services of one of its three dredges for the last three months of the year. Indeed, taking into account the 34 tons recovered from the retreatment of tin shed tailings, the total output amounted to 1,132 tons of ore which was the highest tonnage recorded by the company since its formation in 1920, with the exception of the peak year 1937 when 1,164 tons were produced.

Year	Dredged (000 cu.yd.)	Yield (lb./cu.yd.)	Output (tons ore)	Per Ton Ore Price Duty	Tin Ore Proceeds
1951	3,423	0.72	1,098*	£710 £108	£803,783
1950	3,689	0.67	1,101†	£558 £108	£627,777

*Excluding 34 tons recovered from tin shed tailings.

†Excluding 24 tons recovered from tin shed tailings.

OPERATIONS IN 1951

During the first nine months of 1951 the company's three dredges were in full operation. Two dredges, Nos. 1 and 3, were working in the Sydney-Siam area and No. 2 dredge was retreatment tailings on the old Bangrin Plain. This latter area had been dredged since 1923 and while the yield of 153 tons during the nine months was satisfactory, the life of the area, as anticipated, came to an end on September 29, 1951. Nos. 1 and 3 dredges operating in the Sydney-Siam area, which has a life of approximately 12 years, raised their combined output to 945 tons compared with 898 tons in 1950. Moreover, the price received per ton ore improved by over £150 per ton, with the result that tin ore proceeds showed a substantial expansion over the corresponding figure for the preceding year.

Mining costs were higher, largely owing to wage increases,

higher maintenance and fuel charges, but even so the profit before tax of £405,633 represented an advance of £86,625 over the preceding year's earnings and was a record for the company. Unfortunately, the tax attracted was something of a record though about £83,000 was remitted in respect of Siamese tax and the net available surplus after tax was only modestly higher than in 1950.

Year	Mining Revenue	Mining Costs	Taxation†	Net Profit	Divi- dend	Carry Forward
	£	£	£	£	%	£
1951	803,783	391,892	272,730	132,903	70	31,274
1950	627,777	333,400	192,462	126,546	50*	56,371

*Including special interim dividend of 10 per cent paid during 1951.

†Net Siam and U.K. Estimated Taxation.

THE CURRENT YEAR

Prospects for the current year have been modified somewhat by the lack of employment for the No. 2 dredge and by the necessity to place the No. 3 dredge in dry-dock for repairs to its hull plates as previously announced. This situation is reflected in the production total for the year which at 681 tons shows a decline of 417 tons from the 1,098 tons produced during the year under review.

With the same chairman and board of directors presiding over the fortunes of both Siamese Tin Syndicate and Bangrin Tin Dredging, much in the way of general information and comment applicable to one company is relevant to the other. For example, Bangrin's participation in the development of the lead-zinc mines in the Wanlockhead-Leadhills area in Scotland is described in the article on the opposite page on Siamese Tin Dredging. Similarly, it can be said that both companies are constantly searching for new properties.

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Kaduna Prospectors Ltd.

CHANGES in the capital structure of Kaduna Prospectors, the Nigerian tin producer, have been a feature of the company's activities during its last two financial years. In March 1951 at an extraordinary meeting it was decided to capitalize £12,000 of the reserves by a capital bonus issue of 66½ per cent, or two shares of 3s. each, credited as fully paid, for every three shares held. This raised the company's issued capital from £18,000 to £30,000—a figure more in line with the amount of capital employed in its business.

At the annual meeting held on July 13, 1951 the chairman, Sir Godfrey Fell, told shareholders that the company had under consideration the possibility of returning to shareholders a portion of the company's capital. But in view of the legislation enacted in the 1951 Finance Act, which would render the distribution subject to profits tax, the repayment was deferred. The 1952 Finance Act added further difficulties by the introduction of the Excess Profits Levy. However, on August 7, 1952 the company announced that repayment of 1s. per 3s. share would be made so soon as approval had been obtained from the shareholders and the Court. The reduction became effective on December 15.

REDUCTION OF ISSUED CAPITAL

The result of the scheme has been to reduce the company's issued capital to £20,000 divided into 200,000 shares of 2s. each as against an issued capital of £30,000 divided into shares of 3s. each—the effective share capital throughout the year 1951. While the total authorized capital remained unchanged at £60,000, as a result of the capital repayment, it now represents 600,000 shares of 2s. each instead of 400,000 shares of 3s. each as formerly.

In consequence of this repayment the company will bear, in 1952 only, loss of non-distribution relief for the purpose of profits tax which will probably increase its liability by approximately £2,000. Exact figures are not ascertainable, as yet, of the effect of the repayment on the company's liability under E.P.L. as this will depend on the profits earned in 1952 and in 1953. But the maximum additional liability for 1952 is estimated at £120 and in 1953 at about £600.

Mining operations during the calendar year 1951, if somewhat

disappointing, on the production side, were financially speaking, maintained on a par with those obtained in the preceding year. That total output fell by 15 tons to 69 tons was due, in part, to an unusual shortage of water experienced in the early part of the year and partly to the policy of working a grade of ground which, at lower prices for tin, would have been uneconomic.

Year to Dec. 31	Output (tons)	Sales of Tin Ore £	Mining* Costs £	Taxation £	Net Profit £	Divi- dend %
1951	69	48,997	32,511	10,776	5,481	33½
1950	84	48,574	26,260	11,956	8,090	33½

*Including rail freight, forwarding charges and assays.

The high average price per ton tin prevailing throughout the year enabled the company to maintain revenue from ore sales at the 1950 level. At the end of 1951 stocks of tin ore were valued at £8,620 in the balance sheet.

On the other hand, the scale of Royalty charges payable to the Nigerian Government is geared to the price per ton and with the average price during the year exceeding the £1,000 per ton mark the maximum duty payable per ton of 17 per cent must have been operative over a considerable percentage of the ore sales. Additionally, mining charges per ton—delivered on rail—rose to £445 2s. 0d. compared with £292 2s. 3d. Thus, one way and another mining costs increased by £6,251 but with taxation liabilities lighter by £1,180 and no allocation being made to reserve, the dividend was maintained at 33½ per cent and the carry forward was left slightly higher at £3,540 against £3,125 brought in.

Ore reserves at the end of the year totalled 283 tons compared with 306 tons in 1950.

During the year ended December 31, 1952 output amounted to 77 tons, an increase of 8 tons over the year under review which may be sufficient to offset the drop in the average price per ton tin ore ruling throughout 1952 compared with the preceding year. The company has declared an interim dividend of 12½ per cent or 3d. per share, against the corresponding payment a year ago of only 8½ per cent.

Kaduna Syndicate Ltd.

QUITE naturally many of the experiences enjoyed or suffered by Kaduna Prospectors apply to Kaduna Syndicate and vice versa. Not equally, of course, for although Kaduna Syndicate, which was registered in 1910 to acquire and work alluvial tin mining areas in Nigeria, is only three years older than Kaduna Prospectors it conducts its tin-winning operations on a far larger scale. Accordingly the amount of capital employed in its business is much greater.

Nevertheless, the same reasons which prompted the changes in the capital structure of Kaduna Prospectors during the last two years were operative in the case of Kaduna Syndicate, the differences in the final result being not of kind but of degree. In March 1951 when Kaduna Syndicate brought its issued capital more into line with the total amount of capital employed in its business it capitalized out of reserves a sum equal to its then issued capital, namely, £48,000 by a 100 per cent capital bonus issue, distributing 480,000 shares of 2s. each, credited as fully paid, in the ratio of one new share for every share held.

Kaduna Syndicate also repaid to shareholders a portion of the company's capital at the end of December 1952. The final result has been to reduce the issued capital back to £48,000 divided into 960,000 shares of 1s. each compared with an issued capital of £96,000 divided into 960,000 shares of 2s. each, which was the effective issued capital in 1951. The authorized capital remained unchanged at £100,000 except that it now represents 2,000,000 shares of 1s. each instead of 1,000,000 of 2s. each.

Because of this repayment Kaduna Syndicate will have to bear in 1952 an increase in its Profits Tax liability of approximately £9,600. As in the case of Kaduna Prospectors, no precise figures can, as yet, be given concerning the effect of the repayment on the company's liability to the Excess Profits Levy. But the maximum estimated additional liability for 1952 is put at £600 and in 1953 at about £2,700.

There is one venture in which both companies shared. This was a prospecting venture in which the two "Kadunas" and Maroc Ltd. participated and related to an aerial survey of a part of the Niger Valley carried out in 1950 and followed up by a geological survey in 1951. The initial report submitted by an eminent geologist suggested that gold in payable quantities was to be found in the area and consequently the three companies took out an exclusive prospecting licence. However, in the light

of closer examination by quantitative sampling by pitting and drilling, the licence over the area was abandoned as having failed to show results which would justify further expenditure. This company's share of the cost amounted to £2,937 of which £2,500 was written off by transfer from general reserve during 1951 and the balance of £437 will be dealt with in the accounts for 1952.

With the same board presiding over the destinies of both companies it was not unexpected that Kaduna Syndicate would also take advantage of the high prices per ton tin ruling throughout 1951 to work a grade of ground, which at lower prices for tin would be impractical. The result, as can be seen from the table below is much the same as that achieved by Kaduna Prospectors, only writ large.

Year to Dec. 31	Output (tons)	Sales of Tin Ore £	Mining* Costs £	Taxation £	Net Profit £	Divi- dend %
1951	258	194,481	117,730	49,000	24,782	50
1950	317	186,840	90,539	52,886	33,757	50

*Including depreciation, rail and forwarding charges and assays.

Despite a contraction in output by 59 tons to 258 tons the big improvement in the price received per ton enabled the company to expand its revenue from ore sales by £7,641 to £194,481. Mining costs continued to rise. The Nigerian Government demanded more in Royalty payments and freight charges at £6,572 (£6,886) took virtually the same amount as in the preceding year. The tax attracted was only moderately less so that after payment of dividends totalling 50 per cent (same) which required, net, £25,200 (£26,400) the carry forward amounted to £11,302 compared with £11,134 brought in.

OUTPUT FOR 1952

During the year ended December 31, 1952 output totalled 271 tons, an increase of 13 tons over the production for the year under review. While this small increase in production is hardly enough to offset the lower average price per ton tin ruling during 1952, it is to be remembered that payments to shareholders are now distributed over only half the capital effective in 1951. Thus the interim dividend already declared of 25 per cent, or 3d. per share, contrasts satisfactorily with the corresponding payment a year ago of 16½ per cent.

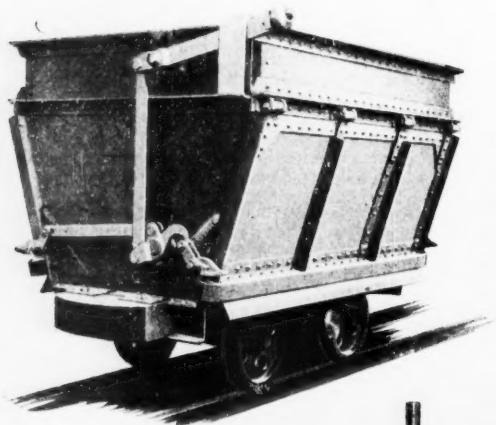
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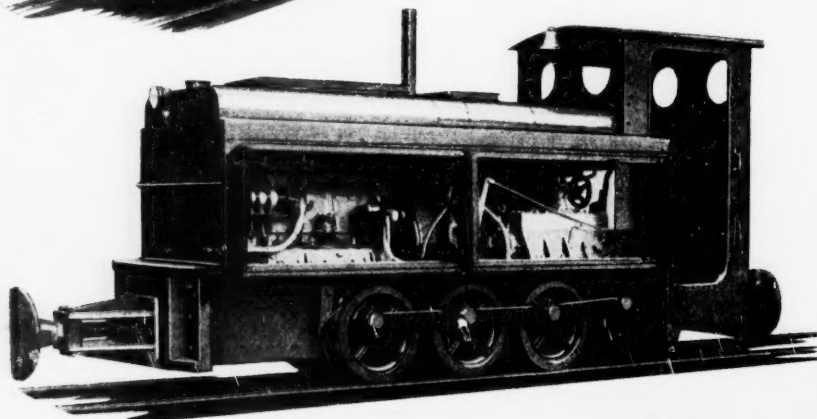
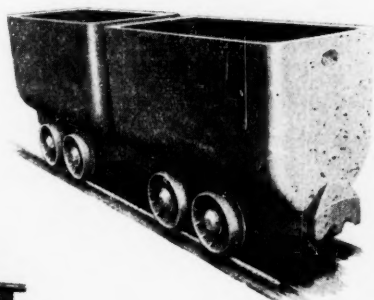
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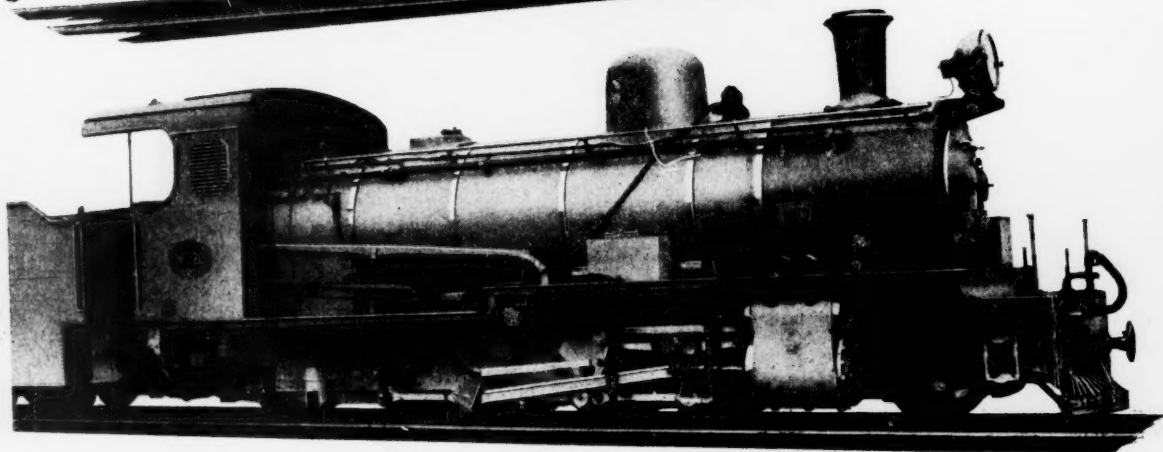
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The Jantar Nigeria Co.

PRODUCTION of both tin and columbite by Jantar Nigeria during the year to September 30, last, showed a decline compared with the preceding year. But the advance in the contract price for its columbite output from £845 to £1,056 per ton, more than offset the adverse effects of the lower average price received from the sale of its tin.

Year to Sept. 30	Production Tin (tons)	Col'bite (tons)	Ore Sales*	Mining† Costs £	Taxa- tion £	Net Profit £	Divi- dend %
1952	258	214	334,337	140,503	120,947	66,214	35
1951	266	232	311,544	132,982	99,652	72,357	35
1950	217	226	173,430	99,307	36,050	31,687	35

*After adjustment of opening and closing stocks, less freight, royalties and insurance.
†Including depreciation.

Thus proceeds from tin and columbite sales improved but the higher mining costs together with the heavier tax burden—including provision of £14,100 to cover the nine months in which E.P.L. was operative—prevented the company from obtaining a higher net profit than in the preceding year.

The company continued to follow a conservative dividend policy and to strengthen its reserves for the very good reason that it will need to be in a strong financial position to provide, out of its own resources, for the modernization of its treatment plant works and to continue its Basalt Lead operation.

COLUMBITE PRODUCTION

With regard to the company's plan to bring its mill up-to-date, this was a task which it was intended to carry out at the first available opportunity, but the fact that there is an appreciable tonnage of columbite still remaining in areas previously worked has accorded this project immediate priority. New treatment plant of the latest design has been ordered, but owing to the delay in obtaining delivery it is unlikely that re-equipment of the plant can be completed before 1954.

The explanation as to why the company has only now considered the possibility of re-working the ground for columbite is, of course, due to the very high price which this metal is now commanding, whereas when columbite was first produced on the

company's property, the price was very low and justified the former working methods which left a proportion of columbite unrecovered. The scheme is to work these old areas by gravel pumping. The necessary equipment has been ordered and it is believed that an appreciable tonnage of columbite can be economically extracted by this method. With the high price levels prevailing for columbite the scheme should provide a useful source of additional revenue.

In this connection the chairman, Mr. C. A. P. Tarbutt, at the last annual meeting took the opportunity to remind shareholders that the U.S. Government was prepared to pay columbite producers 100 per cent bonus on all columbite sold in the U.S.A. under the Defence Procurement Agency Order dated May 28, 1952. Although the net profit for the year under review showed a decline of some £6,000 compared with the previous year, this hardly gives a true picture of the year's results as none of the bonus due on a proportion of the year's output was brought into the accounts.

SHAFT SINKING ON THE BASALT LEAD

With regard to the Basalt Lead operation, the initial shaft sinking operations are now under way and it is expected that by the end of this year sufficient progress will have been made to indicate whether the project will be possible or not. This whole operation must, however, be considered as experimental and while its success would prolong the life of the mine considerably, the cost of winning tin by underground mining would, in all probability, be more costly than the present open-cast methods. The total capital expenditure, including the cost of the initial Basalt Lead operation will, the chairman estimated, absorb more than £100,000 which clearly explains why the company has allocated £40,000 (to general reserve during the year under review and £45,000 the previous year. The general reserve account at the end of March last stood at £95,000 and the carry forward at £9,010 compared with £7,602 brought in.

Output of tin and columbite for the first five months of the current year amounted to 92 tons and 96 tons respectively compared with 102 tons and 84 tons respectively in the corresponding period last year.



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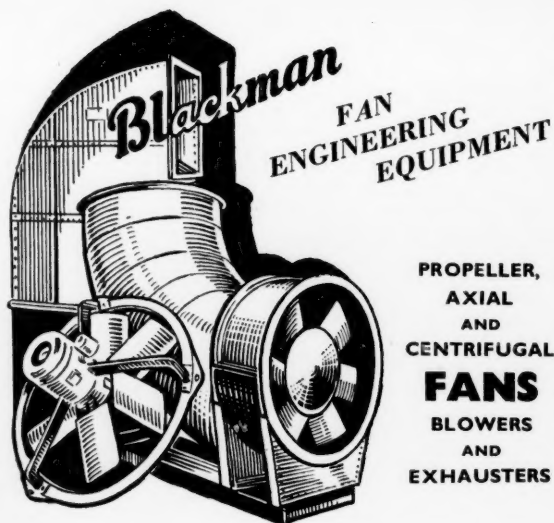
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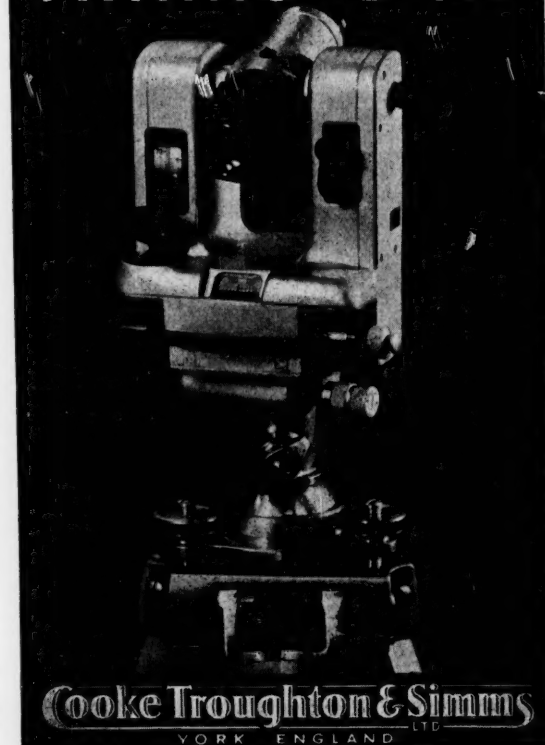
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BERALT TIN & WOLFRAM, which owns and operates in Portugal some of the most important wolfram producing mines in the world, enjoyed exceptional prosperity during the year ended March 31, 1952.

This was not unexpected. The average price for wolfram ore over the year was approximately 500s. per unit compared with approximately 294s. per unit in the preceding year, while wolfram production advanced by 632 tons to 2,392 tons, equivalent to an average output of nearly 200 tons per month. Furthermore, the company had concluded long term contracts with the U.S. and U.K. Governments respectively under which Beralt agreed to supply to the U.S. Government, at a fixed price, 1,000 s.tons of wolfram over the two year period ending June 1953, and to the U.K. Government for the two year period ending September 30, 1953, 100 tons per month, 50 tons of which was to be sold at current market prices and 50 tons at fixed prices. Thus during the year to March 31, 1952, the company had an assured market for some 140 tons per month leaving a balance of nearly 60 tons a month to be dealt with at its discretion.

This is the background to the financial results achieved during the year, the salient features of which are given in the following table and call for little comment.

Year to Production Mar. 31 W/O ₃ Tin	Ore Sales £	Spent in* Portugal £	U.K. Taxation after Tax £	Profit £	Divi- dend %
1952 2,392 89	4,514,695	2,200,838	1,336,570	788,399	200†
1951 1,760 139	1,649,614	733,077	534,251	358,043	100
1950 1,544 257	719,498	576,097	11,700	Dr.285	20

*Including wages, stores, power, and Portuguese taxes.

†50 per cent was described as a bonus.

Profit before tax at £2,174,969 showed a steep rise over the preceding year's figure of £892,294. But, as can be seen from the above statistics, for every £1 realized from ore sales nearly 50 per cent was spent in Portugal while the U.K. exchequer took 60 per cent of the remainder. Even so the company was easily able to double its dividend distribution; to allocate £50,000 (same) to an employees pension fund, to transfer the substantial sum of £400,000 (nil) to general reserve and to increase its forward balance to £178,509 compared with £137,660 brought in.

These results are impressive judged by any standards and two further long term contracts secured during the company's financial year ended March 31, 1953, will have tended to counterbalance the fall in the price of wolfram during that year, but some reduction may be expected from the exceptional figures obtained during the previous year.

Wolfram production for the said financial year at 2,127 tons decreased by 265 tons, but the output of tin, which the company produces on a modest scale, increased during the year to 134 tons against 89 tons.

E.P.L. liabilities will have to be met for the full year instead of for only three months as was the case during the year to March 1952, when liabilities under this heading amounted to £52,500. On the other hand, total E.P.L. liabilities cannot be larger than 10 per cent of the total profits.

THE VALE DA ERMIDA AREA

One of the contracts concluded during the year just ended was with the U.S. Government for the supply of up to 2,500 l.tons of wolfram over a period of five years beginning October 1, 1952, at fixed prices for deliveries during each of those years. The prices for each of the first two years are both well above the current market price and the price fixed for the subsequent three years not far below it. (This was announced by the chairman, Mr. F. Gates, at the last annual meeting held on October 30, 1952, when the price of wolfram was 410s. per unit.)

The other contract concluded was with the U.K. Government for the supply of 100 tons of wolfram per month from October 1953 to September 1955, subject to agreed "floor" and "ceiling" prices.

The contract with the U.S. Government arose out of the interest taken by representatives of that government in the potentialities of the Vale da Ermida area after its inspection by one of their engineers. The present position is that bulk tests on ore extracted from the area are now being carried out, the results of which will largely determine the future of the area.

The Panasqueira Mill has been put into commission again to treat ore from this area and from some of the old wolfram stopes at the top of the Panasqueira Hill.

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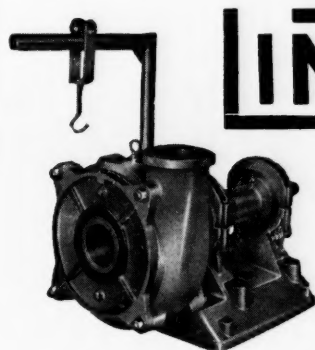
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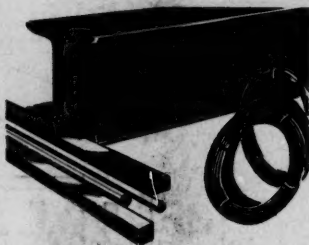
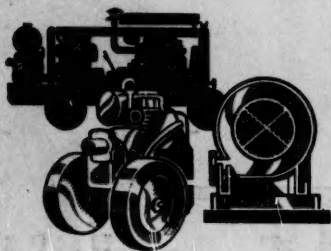
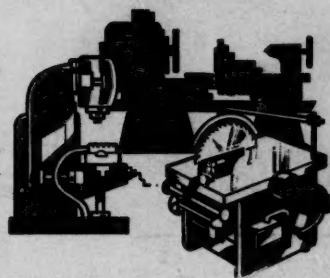
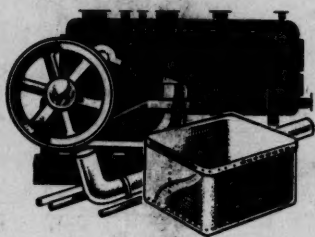
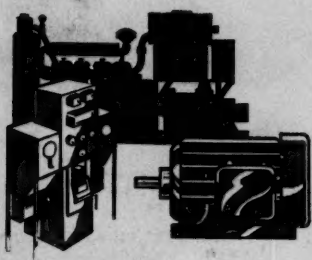
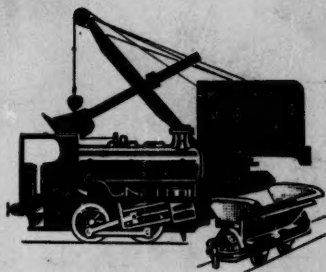
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